A Step Toward Regeneration:

A Study of the Nebraska Food System

by

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for

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Introduction

There is little doubt that agriculture is Nebraska's largest industry. Nebraska is a leader in the production of corn, hogs, beef cattle, and beans, and is a major producer of many other agricultural products. Currently, 21 percent of all Nebraskans are employed on farms and in food related industries.(1) Further, agricultural exports generated $1.8 billion for the Nebraska economy in 1982, a figure which is smaller than usual, due largely to the deep recession which has plagued the national economy.(2) The system of food production and distribution in the state is both extensive and, obviously, an important aspect of the Nebraska economy. It is for this reason, among others, that we should be both pleased with our successes and concerned with the problems which exist in the Nebraska food system.

While a review of our successes would, perhaps, be more gratifying, it would be less useful. The purpose of this study will be to outline the broad contours of the Nebraska food system and to discuss some of its problems. Since the ground which will be covered is extensive and varied we will be served well by a brief preview of the system.

*67 percent of the food which Nebraska consumers eat is produced out of the state. Since this food must be shipped and

handled a number of times the cost to the consumer is inflated.

*The typical size of a Nebraska farm has become larger while the number of farms has decreased, reflecting increasing concentration in Nebraska agriculture.

*The state loses more than 100 million tons of topsoil each year to erosion. This represents a loss of future productivity in the state's largest industry.

*Very impressive opportunities exist for fresh vegetable production and frozen potato and onion ring processing.

The Nebraska food system is both powerful and vulnerable. A relatively small portion of the foods which Nebraskans eat are actually produced in the state. Food is supplied to Nebraskans by way of producers, processors, shippers, brokers, distributors and retailers. Not only does the complexity of this system add to the cost of the food, but the large number of links in this system mean that there are many possible points at which the system is vulnerable to bad weather, increases in energy prices, labor and management disputes, and other circumstances which are beyond our control. Further, as agricultural productivity is lost through soil erosion and chemical fertilizer use, Nebraska agriculture becomes less able to sustain itself.

This study of Nebraska's food system begins with a discussion of the imports and exports of food in Nebraska and their impacts upon the state's economic activity. Then we shall look at soil erosion, chemical fertilizer use, and monoculture. After this we move to an examination of the possibility of producing vegetables for Nebraska consumers and potential opportunities for marketing those vegetables. Finally, we turn to a discussion of some of the progress which is being made throughout the state toward sustainable, regenerative agriculture and more dependable, less expensive sources of food. Included in this final section is a series of recommendations to consumers, farmers, and state government for a better food system.

Food Exports and Imports

Each year Nebraska consumers eat 1.5 billion pounds of food at a cost of 1.37 billion dollars. Since agriculture is such an important industry in the state one may be led to believe that such a large amount of consumption bodes well for the state economy. After all, since the state produced 1.7 billion dollars in agricultural commodities(3), 1.37 billion dollars in food consumption represents substantial support for the state's leading industry. Yet this line of argument ignores an important point. There is a difference between raw agricultural commodities and consumable food products. One difference is processing. Even the simplest foods require processing. Raw fruits and vegetables must be harvested, packed, shipped, and displayed. In addition to processing, the consumption of food in the state will not support the state's agriculture unless farmers grow the foods which people want to eat. In Nebraska, though we produce tremendous amounts of agricultural commodities, we produce little food which people can, or would wish to eat.

Largely because we do little food processing and produce very little of the vegetables and fruits which we consume, Nebraska imports at least 777 million dollars worth of food each year. When we import food we must send dollars out of the Nebraska economy. For this reason food imports represent a substantial

drain on the state economy. If we retain some of these dollars within the state, economic activity can be expanded. This expansion reflects not only the dollars which are retained, but also the economic activity generated through "multiplier effects." An example illustrates this well. Suppose that one dollar's worth of food imports were replaced with in-state production. There would be an initial impact of one dollar as some individual in the state receives one dollar in additional income. Yet, as workers are paid to produce the additional output, and as suppliers are paid for equipment and raw materials, the intial impact generates some secondary impacts on economic activity. So we can see that as an additional dollar is added to the state economy the resulting initial and secondary effects are greater than one dollar. In general, a one dollar increase in spending(generated either by new spending, or by retaining dollars which are presently leaving the economy) will result in an increase in state economic activity of $2.53.(4)

In a similar way, the economic impact of changes in the state's exports of agricultural products may be assessed. The value of Nebraska's exports of agricultural commodities is 1.8 billion dollars. The value of the state's export of consumable food products is 32 million dollars. Clearly, this represents a substantial portion of Nebraska's economic activity. According to the Nebraska Input-Output tables, each new dollar generated in the crop sector expands state economic activity by $2.14. If we wish to expand our production of food for Nebraska consumers, an

issue that must be addressed is the fact that as we produce more fruits and vegetables, for example, acres must be diverted from other crops(principally grain crops). This issue will be addressed briefly a bit later.

To summarize, 67 percent of the food which Nebraskans consume is produced in other states and countries. Obviously, we cannot become less dependent upon out-of-state sources for our bananas and citrus fruit but there are areas, particularly with regard to fresh vegetables, where the state could become much more self-reliant. In a later section we will see how production of fresh vegetables to replace out-of-state imports can improve farmers' income, and increase state economic activity. Nebraska consumers can also benefit by replacing food imports in general. The benefit comes as consumers get higher quality, fresher produce at reduced prices. The lower prices are due, in part, to lower transportation costs. The U.S.D.A. conservatively estimates that $.05 of every food dollar goes to transportion costs. For Nebraska this means that consumers spend an estimated 46 millon dollars annually just to get food from farms in California, Florida, Texas, and other producing states to their tables in Nebraska. This figure could be smaller if we reduced our dependency on distant food sources and produced more food ourselves.

Soil Erosion

A major problem facing the food system of Nebraska is soil erosion. As our farmland loses its valuable topsoil it loses its ability to produce the agricultural commodities upon which the Nebraska economy depends. Topsoil is valuable because it carries the nutrients necessary to support plant growth. This soil is formed as plant and animal tissue and animal wastes decompose into inorganic plant nutrients...a very slow process. Each year in Nebraska more than 117 million tons of topsoil are lost due to water erosion.(5) To put this into perspective, enough soil is washed from Nebraska land each year to bury the state capitol building and the ten acre capitol grounds under 609 feet of rich topsoil. Since the capitol building is 400 feet tall, the statue of the "Sower," which stands on top of the building, would be 209 feet beneath the top of the pile. This does not even include the soil which Nebraska loses due to wind erosion.

An over-all estimate of soil loss due to wind erosion is not available. Basically, this is because of variations across the state in the land's condition. The soil in many areas of Nebraska is sufficiently sheltered from the wind, and has enough vegetation

and residue to prevent severe wind erosion. However, many counties(see map 1) suffer, or are subject to, large wind erosion soil losses. Keith Ticknor, a forester and resource conservationist with the United States Soil Conservation Service, points out two "trouble spots" for wind erosion in Nebraska. First, the western and southwestern wheat growing regions including most of the panhandle are subject to typical soil losses of 5 to 10 tons per acre each year. This high rate of soil loss is an important problem. The soil will regenerate at a rate of 5 tons per acre each year. That is, the soil can tolerate 5 tons per year of erosion--the nutrients, water, and organic matter in the soil can be replaced at roughly this rate. This tolerable rate of soil loss, though, applies to the land's tolerance and not the tolerance of crops. Many crops, corn for example, will sustain damage at soil loss rates well below 5 tons per acre.

The second "trouble spot" for wind erosion in Nebraska is the Sandhills area. Yearly erosion rates of 50 tons per acre are not uncommon on rangeland in this area. Further, increasing irrigation development has led to additional danger for soil erosion in the sandhills area. The Soil Conservation Service estimates that each year 15 to 20 tons of soil are lost on acres where center pivot irrigation is used on sandy soil.

Plants require sunshine, as well as nutrients and water in order to grow. We certainly do not lose any of the former due to soil erosion, but the loss of nutrients and water is substantial. Each year, because of soil erosion, Nebraska loses over 1000 acre

feet of water which would have been available to support plant growth. In addition the state loses 49 million pounds of nitrogen and over 12 million pounds of phosphorous, nutrients which are crucial if plant growth is to be sustained. As erosion depletes the productivity of the soil, additional nutrients must be added. These additional nutrients must be purchased by farmers. And, as we will discuss later, these additional nutrients, which are purchased as commercial fertilizers, have put farmers into a squeeze between rising costs and most recently, falling prices. In order to replace the nutrients lost due to soil erosion alone, Nebraska farmers must pay about 18.6 million dollars for commercial fertilizers.(6)

In addition to the loss of soil nutrients, the value of the state's cropland is diminished through soil erosion. Using the average value of farmland in the state and the average depth of the state's topsoil, we may estimate the money value of this loss to Nebraska. This loss amounts to about 98 million dollars each year, or about 75 percent of the income(less farm expenses) which Nebraska farmers earned in 1980. In the economist's parlance this represents a "disinvestment." While it is a "disinvestment" in money terms, it is more importantly, a "disinvestment" in the future of Nebraska farming and the possibilities for our children to enjoy the fruitful land which is Nebraska. By allowing the land to be blown and washed away we are allowing the destruction of a way of life.

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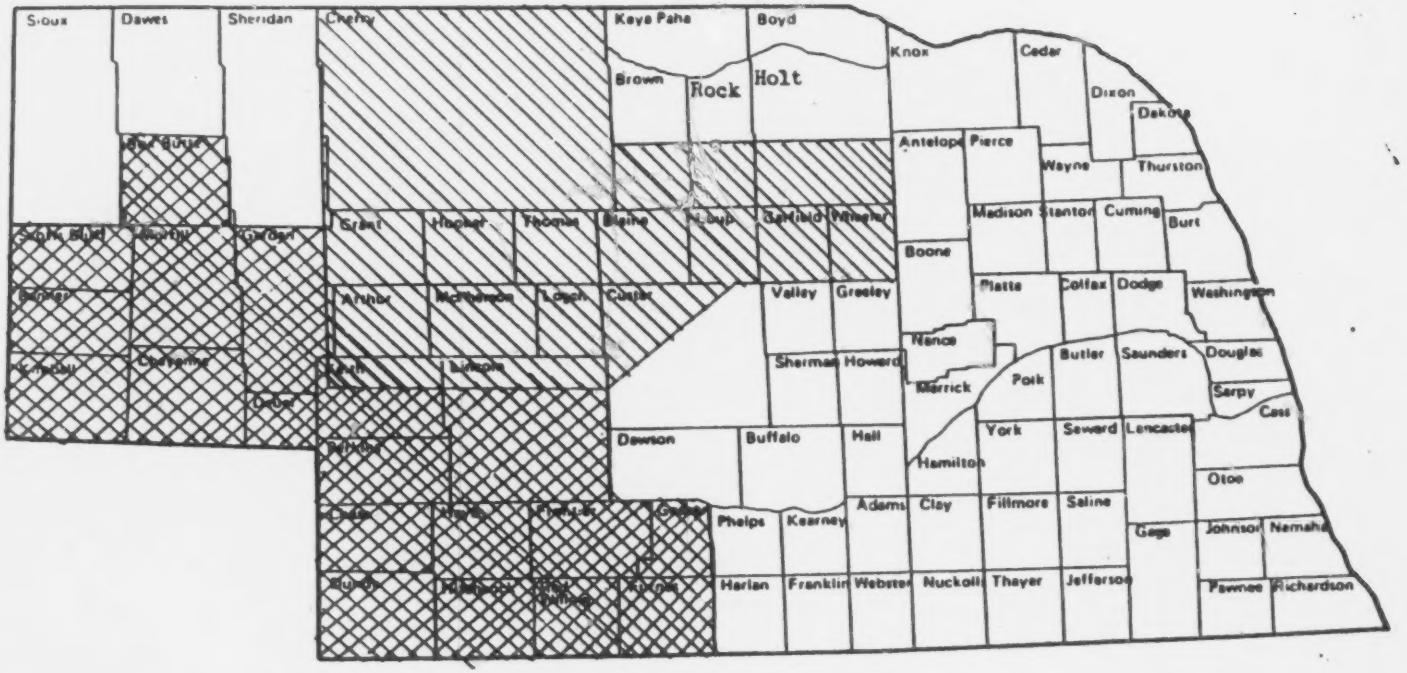
Map 1

EROSION PRONE LANDS BY COUNTY



counties losing 5-10 tons/acre/year of soil

counties with land subject to blowouts

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Monoculture

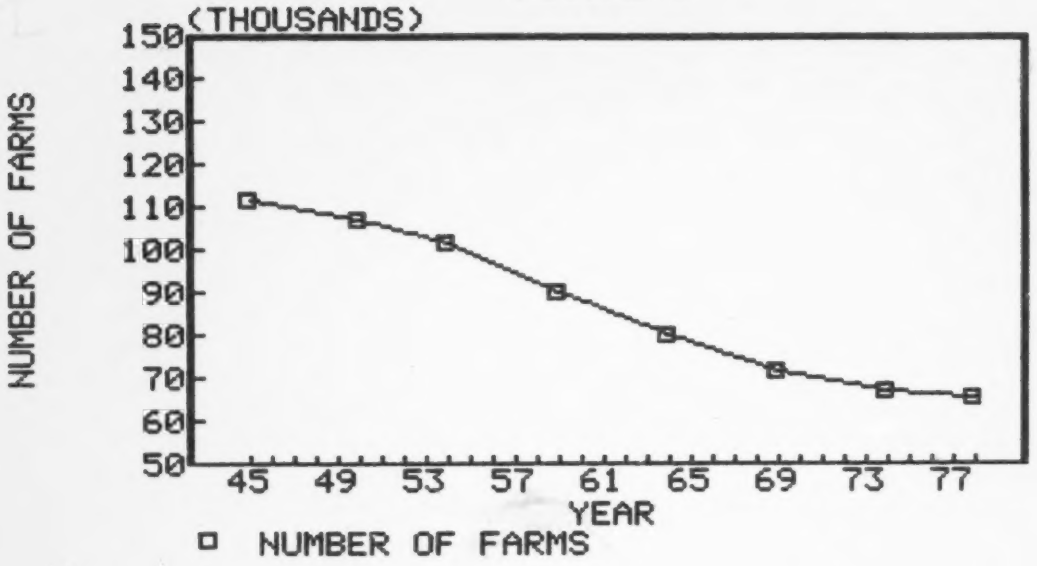
In the name of economic efficiency, Nebraska agriculture has become less diversified. The small integrated farm, one in which several crops and livestock are produced, has largely given way to large monocultural operations. While in the past thirty-five years the acres of harvested cropland in Nebraska have remained relatively constant, the average size of a Nebraska farm has increased by 39 percent, while the number of farms has fallen by 69 percent.(see figures 1 and 2)(7) Further, corn and wheat account for more than 50 percent of the production from Nebraska's harvested cropland. If one adds hay and soybeans the portion of harvested cropland devoted to these crops is 94 percent.(8) The implications of this development are larger than the obvious hazard of farmer's over-dependence upon one or two markets. Since farmers produce few of the inputs necessary for growing these crops they must depend, to a great extent, upon purchased inputs. Particularly, a farmer raising only corn does not have the benefit of livestock manure as a fertilizer. Further, if beef is to be produced in feedlots the cattle must be fed with purchased corn. The manure which is produced then must be "disposed" of, this often results in ecological damage. The

seriousness of this latter problem may be diminished in the future, as markets are organized for feedlot sludge. The Small Farms Action Group is involved in solving this type of waste management problem.

DECLINE IN NUMBER OF FARMS IN NEBRASKA

1945 to 1978

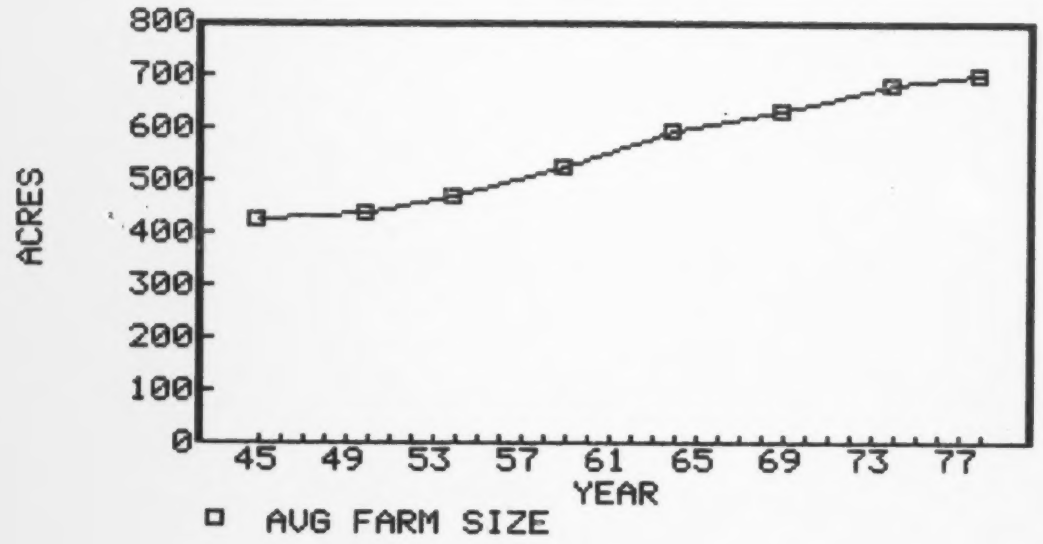
FIGURE 1



INCREASE IN FARM SIZE IN NEBRASKA

1945 - 1978

FIGURE 2



Source: Nebraska Census of Agriculture 1978

The trend toward monocultural farming has been praised for its efficiency. That the outcome has been efficient is arguable. Efficiency means that an activity produces desired effects. If the effect which is desired is an increase in production such that an exportable surplus is produced, then the monocultural trend has indeed been efficient. Over the past twelve years farm exports for the United States have tripled. Nebraska has shared in this boom as one of the United States' top ten agricultural exporters.(9) However, if the desired effect is stable farm communities, increased real income for farmers, improved availability of affordable nutritious food for Nebraska consumers, or the ability to live within ecological margins, another picture of efficiency emerges.(10)

Fertilizer Use

The trend toward monocultural farming means that the farming operation is less able to produce plant nutrients. Thus, these operations must depend upon purchased nutrients. In Nebraska, while the average farm size has increased and the harvested cropland has decreased the use of commercial fertilizers has increased by nearly 600 percent.(11) One may conclude that as farm operations have become larger and more specialized the use of animal manure has become a less feasible option. While it is certainly possible for farmers to use animal manure, a large and specialized grain farm may not produce a sufficient amount of manure to make its use worthwhile. Further, farmers are able to apply increasing amounts of commercial fertilizer in order to gain greater yields per acre.

One problem which is associated with greater use of commercial fertilizers is the effect of these purchased inputs on the costs of production for the farmer. Recently, Nebraska farmers have experienced depressed prices for their commodities. Due to the instability of agricultural markets, periodically low prices are not abnormal. However, net farm income in Nebraska is currently at its lowest level in more than thirty-five years.(12) A major reason for such low net farm income is the large and expanding portion which must be deducted from the farmer's gross receipts due to rising fertilizer costs. Since 1950 these prices

have tripled and now make up almost 10 percent of all production costs.(13)

In addition to the pressure which rising costs and falling prices exert upon the farmer's livelihood, there are also detrimental environmental impacts associated with the overuse of commercial fertilizers. For example, run-off from cropland transports nitrates in the fertilizers to surface waters. Also, especially when combined with irrigation, the nitrates dissolve and percolate through to groundwater supplies. Although nitrate itself is relatively harmless, when it is combined with certain bacteria in the human body it is transformed to nitrites. These nitrites combine with the blood's hemoglobin and restrict the blood's ability to transport oxygen.

Nebraska Farm Income and Financial Condition

If one thing emerges from the statistics of realized net farm income for Nebraska during the 1970's, it is that these income flows are extremely variable.

> As a result of rapid growth of marketings during the early 1970's, realized net farm income peaked in 1973--with 1967 and 1974 also being exceptional years. Then, as production expenses outpaced gross income, realized net income fell, reaching a decade low in 1977. After this low, realized net income began to recover until 1981, when it recorded its most severe decline since this analysis began in 1950.(14)

Larry D. Swanson has pointed out that whether a rural community thrives is closely related to the size of its surrounding farms. Swanson found that as farms become larger and land holdings are concentrated in fewer hands, the number of shops, churches, and professional people in the community decline. The trend in Nebraska, as was shown earlier, has been toward fewer, larger farms. The combination of this trend, a violently unstable flow of income and an increasing burden of farm debt has meant a great deal of hardship for many small farmers and their communities. Swanson also argues that veterans of World War Two comprised the last large group of new farmers in Nebraska. Since that time the average age of farmers has increased. Recently, however, a new group of young farmers has attempted to make their start. The recent trouble in the agricultural economy is

especially hazardous to this group. They may, at least partially, account for the fact that farm auctions and foreclosures occurred in record numbers in 1982.(15) If we value the work and productivity of small farmers they must receive a relatively stable and sufficient flow of income.

The financial condition of Nebraska agriculture is no simple picture to present. Depending upon which group of Nebraska farmers are examined a different picture emerges. For example, a balance sheet for Nebraska agriculture as a whole shows a relatively sound financial position. However, a major reason for this is the large number of non-farmer landlords in the state. These seventy-five thousand landowners own nearly 32 percent of all of the farmland and farms in Nebraska.(16) Yet, these landowners account for little of the agricultural debt in the state.(17) These non-farmer landlords are in relatively good financial position and tend to make the overall picture of Nebraska farm finance appear sound. However, if one looks at the financial position of Nebraska agriculture with the holdings of these non-farmer landlords excluded, a very different picture is seen.

There are 42,000 indebted farmers in the state. Many of these farm operators increased the amount which they owe during the 1970's. This was a period which saw land values, generally the basis upon which money was loaned to the farmers, rise substantially. More recently, however, the value of the land has decreased. This, coupled with low prices for the commodities that

farmers grow, has caused a financial crisis. According to one observer, many farmers are so deeply in debt, relative to the value of their farms, that they are becoming credit risks. He emphasizes that, "whether these farmers could sustain another low-income year with further asset depreciation is debatable. Economic survival lies in the balance--a delicate balance indeed."(18)

Farm Income and Vegetable Production

The deterioration of the financial condition and the income of Nebraska farmers will not be reversed by any single policy. However, many farmers may be able to improve their situations by turning from more traditional Nebraska crops to crops which can be sold to Nebraska consumers. Nebraska farmers could increase their income by diverting some production from traditional crops to vegetables and fruits. Since crop production is currently based on developing overseas and out-of-state markets for agricultural commodities, this opportunity for growing crops for local consumption has generally been overlooked.

In the area of processed foods, Nebraska is almost totally dependent upon imports from other states. The fact that Nebraska imports some food items is, of course, not shocking nor is it necessarily negative. In a large economy such as that of the United States, there are comparative advantages to producing certain products in a region and importing others. The region's climate, geography, population, traditions, politics and other factors play roles in determining the extent to which a product is produced. At this time the Nebraska Department of Economic Development is studying these factors in order to determine if they are the reason for Nebraska's substantial dependence upon

imported processed foods. A preliminary study offers evidence which supports efforts directed toward increasing the production and processing of potatoes and onions in the state.(19) Further work will be done with regard to processing other Nebraska vegetable crops.

Substantial opportunities exist for production of vegetables and fruits for in-state consumption. Let's examine the possibilities for vegetable production for example. Using estimates of per capita food consumption in the United States(20), specific production data for vegetable crops grown in Nebraska(21) and some estimated yields I was able to arrive at estimates of Nebraska's dependence upon imports of specific vegetable crops(table 1). What these columns of figures show is great potential for in-state production of vegetable crops to offset out-of-state purchase. While column 4 reflects an estimate of Nebraska's over-all dependency, column 5 shows an estimate of our current dependence during the time of year, and with regard to some of the crops that Nebraska could be producing. In effect, column 5 is an estimate of the possibilities for in-state marketing of Nebraska vegetable production. In terms of the agronomic prospects, the outlook is bright. A 1967 study from the University of Nebraska-Lincoln(22) pointed out that the climate and soils are suitable for high levels of production of a wide range of vegetables.

TABLE 1

NEBRASKA CONSUMPTION, PRODUCTION, IMPORTS, AND EXPORTS OF VEGETABLES

	① PER CAPITA CONSUMPTION	② STATE CONSUMPTION	③ PRODUCTION[1]	④ % IMPORTS[11]	⑤ % IMPORTED IN SEASON[111]
TOMATOES	11.3	17,917,110.5	1,340,360.9	92.5	77.33
BROCCOLI	1.9	3,012,611.5	29,400.0	99.2	97.60
CARROTS	6.3	9,989,185.5	44,088.0	99.5	98.92
ESCAROLE	.6	951,351.0	NC	100.0	
GREEN PEPPERS	3.2	5,073,872.0	29,700.0	99.4	98.57
SPINICH	.6	1,268,468.0	NC	100.0	100.0
ARTICHOKES	.5	792,792.5	NC	100.0	100.0
ASPARAGUS	.3	475,675.5	80,000.0	98.3	95.9
SNAP BEANS	1.3	1,061,260.5	1,167,500.0	-.1	-
CABBAGE	7.6	12,050,446.0	20,040.0	99.8	99.5
CAULIFLOWER	1.7	2,695,494.5	11,250.0	99.5	98.98
CELERY	7.2	11,416,212.0	NC	100.0	-
SWEET CORN	6.5	10,306,302.5	10,590,863.7	-.02	-
CUCUMBERS	4.1	6,500,898.5	456,855.0	93.0	82.28
EGGPLANT	.5	792,792.5	92,000.0	88.4	64.83
GARLIC	.6	951,351.0	NC	-	-
LETTUCE	23.8	37,736,923.0	22,242.3	99.9	99.82
ONIONS/SHALLOTS	9.2	14,587,382.0	944,673.8	93.5	80.38
TOTALS		141,702,700.5	14,756,973.7		

(i) Yields are based upon 1978 Nebraska Census of Agriculture, Co-operative Extension Service, literature, University of Nebraska-Lincoln, and 1982 USDA Vegetable Summary

(ii) % Imported = $1 - \frac{\text{Production}}{\text{Consumption}}$

(iii) % Imported in season = 1 - Production/Consumption during portion of year in which state consumption could be from state production

85.1 = $\bar{x}$

33.5 = s

$s_{w/o\ outliers}$ = 3.73

estimated range of dependency 81.4 - 88.3

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The preceeding discussion suggests that significant possibilities exist for increased production of vegetables for in-state consumption. However, the question remains, can a farmer derive sufficient income from vegetable production to more than offset whatever current income is gained from his other production? A preliminary answer is yes. LuAnn Finke of the University of Nebraska-Lincoln Extension Service points out that since the operations involve "intensive" rather than "extensive" agriculture, and vegetable crops are higher in value than corn or soybeans, less land, chemical inputs and capital are required to gain a significant increase in income. This assertion is warranted by examination and comparison of some historical data and comparison of two typical farms.

The period from 1978 to 1982 will be examined. Tables 2 and 3 show estimated crop budgets for one acre of irrigated corn and one acre of irrigated tomatoes. The farm on which the acre of corn is grown is in southeast Nebraska and consists of 600 total acres divided between three or four crops. Also, most of the labor is provided by the farm family. It is also assumed that the crops are sold within the year of production at the average spot price.(23) The acre of tomatoes is grown on a farm of thirty acres which has displaced thirty acres of corn production. The land is not marginal, it is farmland which had been used to produce traditional Nebraska crops which are now being displaced by vegetable production. Other vegetable crops are also produced

on this farm, with the degree of diversity owing to contractual commitments, local climate, soil and regional tastes. The crops are harvested by hand and it is assumed that they are sold at the "fresh market" price. This assumption is very conservative. The "fresh market" price is that price which is paid by fruit and vegetable brokers directly to large scale growers is Califoria, Texas, and other producing states. There is generally a sixty to eighty cent margin per pound between this price and the retail price. Depending upon the method of marketing the products their price could be greater. Finally, one-third of the tomato yield was subtracted to account for loss due to unsatisfactory fruit and damage during the harvest. This loss could be diminished somewhat as the pickers became more experienced.

TABLE 2

CROP BUDGET FOR HAND HARVESTED TOMATOES
(SOUTHEAST NEBRASKA)

Yield = 20,000 - 1/3 loss = 13,400
"FRESH MARKET" PRICE = .20/pound (i)

1982	HOURS /ACRE	LABOR(ii) COST	FUEL	DEPRECIATION PURCHASED IN 1978 TRACTOR	IMPLEMENT	TOTAL
Pre Harvest						
PLOW	1.5	7.50	2.93	3.82	6.83	22.58
DISC (2x)	1.0	5.00	1.95	2.54	8.21	18.71
LANDPLANE	1.0	5.00	1.95	2.54	11.61	18.70
BED	.7	3.50	1.38	1.78	2.05	9.41
FERTILIZE AND SHAPE	.5	2.50	.98	1.28	2.79	8.05
PLANT	2.0	10.00	3.91	5.09	6.58	27.58
CULTIVATE (3x)	1.5	7.50	2.94	3.82	2.98	18.74
SPRAY (3x)	1.5	7.50	2.93	3.82	4.85	20.60
IRRIGATE (9x)	9.0	16.00	32.44	--	--	57.44
HOE (2x)	15.0	52.00	--	--	--	67.50
Subtotals	33.70	146.00	51.41	24.69	45.90	269.31
INTEREST ON LABOR, FUEL, INPUTS AND REPAIRS PER ACRE						12.24
PICKUP, TRAILER TOOLS AND SHAPE UP COST						65.32
						77.56

Purchased Inputs	Unit	Quantity	Cost	Total
FERTILIZER				
Liquid Nitrogen	pounds	50	.27	13.50
Nitrogen	pounds	50	.28	14.00
Phosphorus	pounds	40	.34	13.60
SEED AND PLANTS	number	3112	.03	93.36
INSECTICIDE	pounds	6	1.89	11.34
IRRIGATION WATER	acre-feet	5	12.38	61.94
TAXES	dollars	-	11.67	11.67
LAND CHARGE (iii)	dollars	-	170.00	170.00
Sub Total				389.41
HIRED LABOR FOR HARVEST	hrs	40.00	3.50	140.00
TOTAL COST				876.28

(i) Price date from Vegetable Summary, USDA
(ii) Prices were obtained from Estimated Crop and Livestock Production Costs, University of Nebraska-Lincoln Agricultural Extension Staff. (1982)
(iii) Land charge reflects a generous 1978 per acre price. The formula which was used to calculate this was

$$\text{Land charge} = \frac{\text{Land Price}}{\text{Interstate}}$$

$$\$170. = \frac{\$1700}{10\%}$$

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TABLE 3

ESTIMATED 1982 COSTS PER ACRE, SOUTHEAST NEBRASKA

CORN FOR GRAIN, CENTER PIVOT IRRIGATED, ELECTRIC

025

TOTAL CROPLAND ACRES 600.0
ACRES THIS CROP BUDGET 132.0

EXPECTED YIELD PER ACRE 130.0
ANIMAL UNITS OF GRAZING 3.0

OPERATION	ACRES /HOUR	PURCHASED MATERIALS AMOUNT /ACRE	PURCHASED MATERIALS COST /UNIT	MACHINERY COSTS FUEL AND LUBE	MACHINERY COSTS REPAIR AND MAINT.	MACHINERY COSTS FIXED	TOTAL COSTS
TANDEM DISC	10.63			0.79	0.96	3.59	5.35
ANHYDROUS APPLICATOR	6.87			1.23	0.84	3.30	5.37
NITROGEN-NH3		150.00	0.16				24.00
NH3 SUPPLY TANK		150.00	0.01				1.50
TANDEM DISC	10.63			0.79	0.96	3.59	5.35
FIELD CULTIVATOR	8.96			0.94	1.56	4.35	6.85
PLANTER (FERT., HERB., ETC)	4.90			1.23	2.76	6.85	10.84
S ED-SINGLE X		0.30	62.00				18.60
18-46-0 STRTR		50.00	0.16				8.12
INSECTICIDE		1.00	12.00				12.00
HERBICIDE		1.00	6.40				6.40
ROW CROP CULTIVATOR	5.29			1.14	1.32	3.31	5.77
SPRAYER	CUSTOM						1.25
BORER SPRAY (1/3 YR)		.30	9.00				2.70
IRRIGATION, CENTER PIVOT							
9.0 IN. APPLIED	16.00*			32.44	6.43	78.86	117.73
COMBINE, CORNHEAD	3.18			2.59	3.75	16.96	23.30
TRUCK	CUSTOM						13.00
GRAIN AUGER	12.00*			0.05	0.55	2.00	2.60
GRAIN DRYER (1/2 CROP)	10.00*			0.37	1.50	2.50	4.37
TOTALS				41.58	20.63	125.33	275.11

* - MINUTES OF LABOR/ACRE

CASH COSTS		
PURCHASED MATERIALS	73.32	
FUEL AND LUBE	41.58	
REPAIRS AND MAINTENANCE	20.63	
CUSTOM HIRE AND MACHINE RENTAL	14.25	
INTEREST ON OPERATING EXPENSE	15.98	
(149.78 x 16.00% FOR 8.0 MONTHS)		
Total Cash Costs		165.76
LABOR		
DIRECT LABOR	10.72	
(1.8 HRS x 5.00/HR x 1.2 (OVERHEAD))		
TOTAL CASH COSTS AND LABOR		176.47
FIXED COSTS		
FIXED MACHINERY COSTS (INCLUDES INTEREST AT 14.00%)	125.33	
REAL ESTATE TAXES	11.67	
INTEREST ON LAND ($1166.67 VALUE/A x 6.00% x 1.0)	70.00	
TOTAL FIXED COSTS		207.00
TOTAL COST, EXCEPT OVERHEAD AND MGT.		383.47
OVERHEAD AND MANAGEMENT		
OVERHEAD (TOTAL CASH COSTS x 5.00%)	8.29	
MANAGEMENT CHARGE (0.10 x ESTIMATED YIELD)	13.00	
TOTAL OVERHEAD AND MANAGEMENT		21.29
TOTAL COST PER ACRE		404.76
(BASED ON ESTIMATED YIELD)		3.11

BEST COPY AVAILABLE

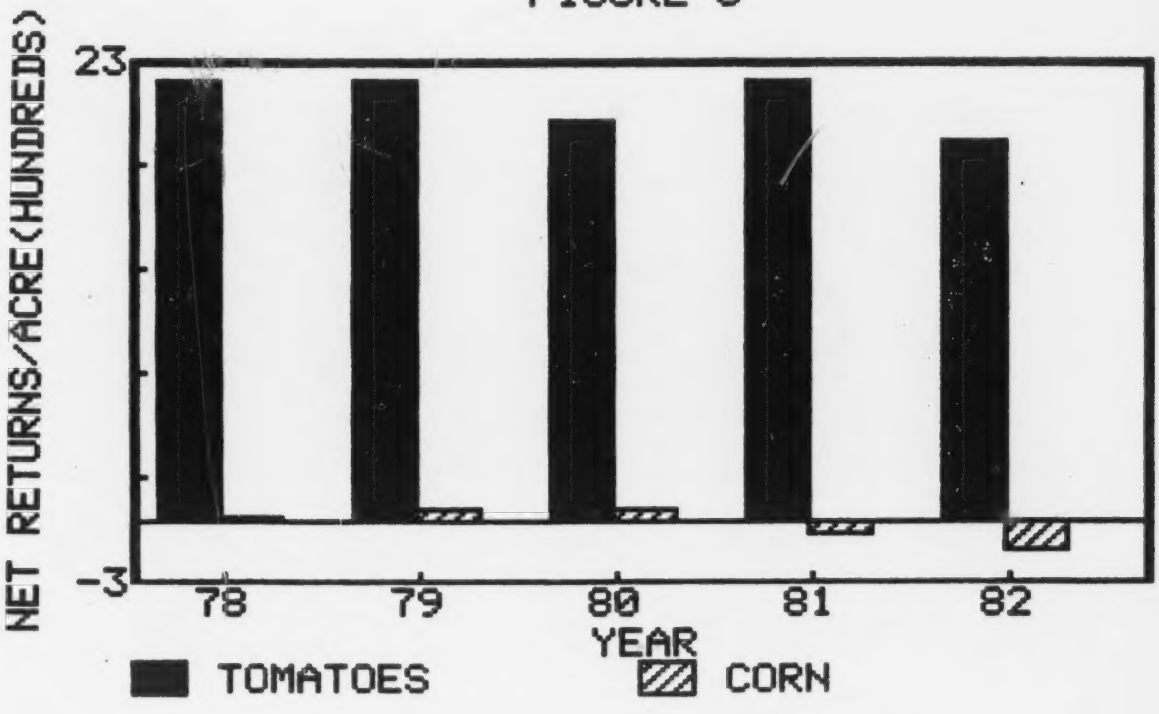
Based on these budget estimates, the tomatoes were the more profitable crop. Figure three shows a comparison of the net returns from these two acres. The acre of tomatoes clearly returned a greater flow of income to the farmer. Specifically, the lowest estimated return per acre for tomatoes would have been $1803.67, while the best estimated return for corn was $82.21 per acre.

Further, the budget from which the tomato return per acre was derived was quite conservative. If some of this conservatism is eliminated, the returns are even greater. Changes such as outright ownership of the land (which eliminates the $170 land charge), growing without irrigation and its expense, a yield loss of one-eighth rather than one-third of the yield and estimated yields as high as those offered in the 1967 Nebraska vegetable study were included in a revised tomato crop budget. The estimated net return for 1982 was $3080.41. Finally, these budgets were compiled considering only typical capital and chemical intensive technology. However, since less land is required for a vegetable farm, regenerative agriculture could be a very suitable option. This is because regenerative agriculture is labor intensive and is most easily implemented, at least at the present time, on small farms. Typically, the organic farmer could reduce energy costs by 60 percent (about $20 in the estimated budget) and reduce significantly his fertilizer cost by

using the manure of two, or three dairy cows and getting milk for the family in the bargain.(24,25) This opportunity deserves more attention than can be given here.

COMPARISON OF NET RETURNS FOR CORN AND TOMATOES IN NEBRASKA

FIGURE 3



Vegetable and Fruit Production and Increasing Nebraska Economic Activity

While it is possible for farmers to increase their incomes by producing vegetables for local consumption, the state will also benefit through greater economic activity.

When Nebraska consumers purchase food from producers in other states the consumer's dollars, which had been circulating in the Nebraska economy, flow to the economies of other states. This creates a leakage of money from the Nebraska economy. As a result, the level of economic activity in the state is not as great as it would be if more food was produced for in-state consumption. If Nebraska farmers produced more of the vegetables and fruits which Nebraskans consume, and if Nebraska developed a larger food processing industry, the increase in the state's economic activity would be substantial.

We may get an idea of the potential economic impact of producing vegetables and fruit in Nebraska by examining the net impact of producing tomatoes for in-state consumption. Since the food distributor, not the consumer is involved in the transaction which sends money out of the state, it is the price the distributor pays which is important. Typically, $.50 per pound is the price that is paid for tomatoes. Note that this is more than twice the price assumed in the tomato crop budget. According to the food import and export data which are included in table 1, 4.5

million pounds of tomatoes, which are grown out of state, are consumed by Nebraskans during the season when the state could be producing them.

In order to assess the impact of diverting the outflow of dollars, which I estimate to be almost 2.3 million dollars annually, we also must look at the value of the commodity exports which are displaced in order to grow tomatoes. This is necessary because the land on which tomatoes will be grown must be of a high quality, rather than marginal farmland. Appendix 1 shows a general formula for deriving the net economic impact, including multiplier effects, of these diverted outflows of dollars. This appendix also includes the computations for the net impact of producing tomatoes within the state for Nebraska consumers. This net impact amounts to 5.1 million dollars in additional economic activity for Nebraska. This is due to diverting the money flows out of the state from only one vegetable which Nebraskans consume. If we produced all that we could of the vegetables and processed foods which we consume, the impact upon the state's economy would be most impressive.

Marketing Alternatives

In 1980 the United States Department of Agriculture conducted a survey of direct marketing activities in Colorado, Maryland, New York, Tennessee and Wisconsin. In these states, from 1 to 20 million dollars in fruits and produce were sold. The methods which farmers used ranged from road-side stands to permanent Farmers' Markets in some of their state's larger cities.(26) This study was mandated by the Farmer-to-Consumer Direct Marketing Act of 1976. This act was meant to promote the development and expansion of direct marketing. Little funding was allocated to the program and it was not renewed. Direct marketing is a channel for farmers to gain access to retail markets and higher prices. The higher prices are possible due to the absence of the "middle man," whose share of the retail dollar is approximately 75 percent.(27) There are, however, several drawbacks to reliance upon direct marketing. First, direct marketing is most effective for delivering to relatively large urban areas--the Nebraska population is widely dispersed. Second, direct marketing operations are largely independent, this represents a significant problem with regard to coordinating the supplies of Nebraska-grown produce and Nebraskans' demands for produce. Finally, there is the distribution system through which produce is delivered. This system already distributes produce to Nebraska consumers, so it is

not necessary to construct a totally new alternative distribution system. This system runs from the out-of-state producers to produce brokers to regional distributors to local supermarkets and consumers. If the in-season level of sufficiency is to be reached with Nebraska produce, some means should be found to substitute these for the out-of-state products presently in the distribution system.

Another marketing alternative for Nebraska produce growers is a commodities exchange. This brings together bulk buyers (grocers, food buying clubs, restaurants, schools etc.) with local growers. A pilot program in Seattle, Washington used a type of forward contract to coordinate the deliveries of commodities.(28) Buyers placed orders with a central exchange, specifying the quantity of the commodities they wished to purchase and the delivery date. The exchange then contracted the farmers to fill the order. Generally, the reactions by those involved were favorable, complaints largely owed to the fact that the operation was "cash and carry." While on a large scale a bulk food exchange may be an option for urban areas, smaller rural communities could form similar organizations. The forward contract, not the bulk food exchange, is the institution which is most feasible. While bulk food exchanges could provide substantial marketing outlets for Nebraska produce, forward contracts can provide the means to allow Nebraska farmers access to the existing produce delivery system.

In interviews with Nebraska produce distributors, the

reaction to such a prospect was favorable, provided a suitable product could be delivered at a price comparable to that which is presently paid. One distributor offered that his firm already purchases potatoes from Nebraska sources. Earlier in this study it was shown that a respectable return could be gained by produce growers at a price well below that which is typically paid by the local distributor. Some have argued that large out-of-state produce growers require Nebraska produce distributors to purchase these grower's produce throughout the year, thus providing the growers with a consistent market demand. Such allegations of "tying contracts" with out-of-state produce growers seem, basically, to be unfounded. The local distributors do not deal directly with the out-of-state growers. Instead, produce brokers in several states contract for the produce and sell it to the local distributors. The distributors, rather than relying upon one broker, use different brokers, depending upon the quality and the price of the crops. A producer cooperative could serve as a broker for Nebraska produce. Further work should be done in this area, yet two functions for such a cooperative "broker" may be tentatively outlined. First, the "broker" must coordinate deliveries so that a sufficient and reliable supply of Nebraska produce is available. Second, it would be necessary for the "broker" to set and maintain price standards for Nebraska produce. This is necessary in order to sustain the income gains of the producers.(29)

Progress and Recommendations

Nebraska possesses some of the most fertile land in the nation and is consistently a top agricultural exporter, yet most of the foods that Nebraskans consume are imported from out-of-state suppliers. Appendix 2 shows that 67 percent of the foods which are consumed by Nebraskans are imported. Further, the position of Nebraska farmers is becoming increasingly poor. They have experienced declining incomes and prices, and increasing costs for their production inputs. Finally, the very basis of Nebraska agriculture is being literally eroded. In Nebraska more than 100 million tons of topsoil are lost due to sheet and rill erosion every year. This means that for every bushel of corn which is harvested approximately 90 pounds of topsoil is eroded.

The situation which is portrayed in this study and in the preceeding paragraph should not be taken to imply that nothing is being done to correct problems in Nebraska's food and agricultural systems. In order to minimize soil erosion, the University of Nebraska-Lincoln school of agriculture is studying and encouraging farmers to adopt minimum tillage practices. This should not only lead to less soil erosion, but also to lower production costs for farmers. Some departments of the University are also involved in studying sustainable, regenerative agriculture. For example, the agricultural extension-horticulture service is working to study

and promote in-state production and direct marketing of produce.

The Office for Policy Studies is also involved in projects which are relevant to food system analysis. Most notably, this institution is developing a comprehensive food system model for the state which will trace nutritional, energy, commodity and money deliveries. Also, the Office for Policy Studies is studying the effects of the development of center pivot irrigation upon the sensitive ecology of the Nebraska Sandhills. In addition, the environmental implications of nitrate contamination are being investigated.

The Small Farms Action Group is involved in instituting direct markets for Nebraska farmers as well as encouraging farmers to produce for direct markets. This group also develops and promotes large scale composting and waste management for cities.

The Nebraska Department for Economic Development has recently completed a study which shows the possibility for the development of potato and onion processing in the state. A similar study focused upon vegetable processing is currently under way.

Recommendations to State Government

a. Encourage farmers to produce several crops in such ways that compost and animal wastes can be integrated into the process.

b. Encourage cities to compost their waste and make it available to local farmers and gardeners.

c. Help farmers and farm groups develop producer cooperatives which can market farm products and make bulk purchases of the farm inputs which are necessary.

d. Continue and expand research at the University level into sustainable, regenerative agriculture.

e. Develop programs through which experienced farmers can share skills with newer, less experienced farmers.

f. Develop criteria for organic soil amendments which account for the differences of these materials from their commercial counterparts. Organic material, rather than working simply as a fertilizer, increases the ability of the soil to retain water and reduces topsoil loss due to erosion. However, these effects are realized over time. The current model for testing fertilizer material only judges the immediate effects

of a fertilizer upon plant growth, the effects of organic materials are cumulative and therefore not adequately tested by this model.

g. Create financial supports which are necessary to deliver income to farmers while they adopt regenerative methods. There are significant costs involved in the aquisition of necessary capital to change an operation(different technology is involved in tomato production than in corn production and the capital may not be perfectly transferable between these crops). Also, once soil has been depleted, through repeated use and repeated chemical applications with little amendment, time, money, and effort are necessary before it can be regenerated.

Recommendations to Local Government

a. Develop local farmers' markets. This is a way to allow farmers to gain access to retail markets and a way for consumers to purchase healthy, high quality foods at reasonably low prices.

b. Establish criteria for the quality of foods which are direct marketed. These criteria should pertain to the trace levels of pesticides,and herbicides as well as insect contamination and aesthetic considerations.

c. Certify plots as organic. In this way farmers will be able to gain any premium which may accrue to organically grown produce. Also, this practice will protect consumers and assure them that they are, indeed, receiving organically grown produce and not produce which is merely labeled as such.

d. Encourage local restaurants, hospitals, schools and other institutional purchasers of food to make bulk purchasing arrangements with local farmers. A bulk food buying system such as that in Seattle, Washington should be investigated.

e. Educate students in the importance of proper nutrition and in the elements which make up a healthy diet. Students should be involved in planning and preparing meals that are healthy and tasty and use Nebraska grown foods whenever possible.

f. Create community gardening programs; in this way people in urban areas can grow some of their own food even though they may not have garden plots of their own.

Recommendations to Farmers

a. Organize producer cooperatives to market fruits and vegetables grown in Nebraska to supermarkets, restaurants and schools.

b. Work cooperatively with the consumer by selling directly to the public. This will ensure a higher price for the farmer's product and fresher produce for the consumer at a lower cost.

c. Consider small scale processing on the farm such as processing sausage, cured meats, cheeses, etc.

d. Investigate before planting what specific varieties of crops purchasers wish to buy by surveying bulk food purchasers in your area.

e. Take land that is severely eroding out of production.

f. Use marginal lands for grazing livestock instead of crop production.

g. Have soils tested accurately to determine the nutrient value of the soil and its fertilizer needs in order to prevent overuse of costly, energy-intensive fertilizers.

h. Take advantage of the services offered by county extension agents and the soil conservation service. Use their technical skills to help you manage Nebraska's most important economic resource...the soil.

i. Investigate the possibility of using alternative energy sources such as the conversion of manure to methane or the use of solar heat for crop drying and other on-farm energy requirements.

j. Consider management practices that will reduce the need for chemical fertilizers, pesticides, and other expensive inputs.

k. Develop on-farm fertilizer sources by growing nitrogen-fixing legumes and green manure crops.

l. Diversify production regarding not only types of crops but individual strains of a single crop so as to reduce the risk of pests blighting the entire crop.

Recommendations to Consumers

a. Support Nebraska fruit and vegetable producers by purchasing Nebraska grown produce.

b. Form food buying clubs in order to take advantage of discounts for bulk purchases and to obtain whole foods that have undergone little processing.

c. Plant gardens and learn to process foods for use during winter months. Consumers can form community processing centers in order to share the cost of canning equipment as well as to develop the community bonds that come from shared labor.

d. Investigate the nutritional claims which processors make for foods which are purchased. This could be a part of the task for a public interest research group.

e. Investigate the prospects for community greenhouses which could be used to produce foods during the seasons when the weather in Nebraska does not cooperate.

Appendix 1

Net Economic Impact Formula

D=Diverted Money Outflow

D=Pf+Sw

Pf=Purchases from Farmers

Sw=Savings by Wholesalers

Mi=Multiplier for Irrigated Crops

Mw=Multiplier for Wholesale Grocery Products

I=Displaced Money Inflows

Ic=AcxPcxYc

Ac=Acreage Diverted from Corn Production

Pc=Price of Corn

Yc=Estimated Corn Yield

Net Economic Impact Formula:

N.E.I.=((PcxMi)+(SwxMw))-(IcxMw)

APPENDIX II

Notes

(1) Nebraska Employment Statistics. Nebraska Department of Labor, 1982.

(2) Nebraska Agricultural Statistics, Nebraska Department of Agriculture.

(3) Unpublished data compiled by the Bureau of Business Research, University of Nebraska-Lincoln, 1983.

(4) Nebraska Input-Output Tables, F.C. Lamphear, 1977.

(5) U.S.D.A. Soil Conservation Service, National Resouces Inventory, Basic Statistics 1977, revised 1980.

(6) This figure was calculated by multiplying the number of acre feet of topsoil lost each year by the average phosphorous and nitrogen content of an acre foot of soil (converted to fertilizer equivalents). The resulting figure represents the total nutrient loss per year which was then multiplied by the average prices for nitrogen and phosphorous.

(7) United States Department of Agriculture, Nebraska Census of Agriculture, 1978, pg. 1.

(8) Ibid, pg.18.

(9) Nebraska Agricultural Statistics, Nebraska Department of Agriculture,

(10) See Wendell Berry, The Unsettling of America, (New York: Avon Books, 1977) pp.41

(11) Ibid, Nebraska Agricultural Statistics.

(12) Jerry Dichert, "Nebraska Farm Income," Bureau of Business Research, University of Nebraska-Lincoln, April 1983.

(13) United States Department of Agriculture, Index of Prices Paid and Recieved by Farmers, 1960-1982.

(14) Ibid, Dichert.

(15) Maria Padilla, "Are Times Bad Down on the Farm?" Wall Street Journal, August 27, 1982.

(16) Bruce B. Johnson, "Financial Conditions in Nebraska Agriculture," Business in Nebraska, Bureau of Business

Research, University of Nebraska-Lincoln, June 1983.

(17) Ibid

(18) Ibid

(19) Nebraska Department of Economic Development, Frozen Potato and Onion Processing, August 1983.

(20) United States Department of Agriculture, Food Consumption Prices and Expenditures, 1982.

(21) R. E. Neild, D. S. Wuland, and J.O. Young, "The Potential For Vegetable Production in Nebraska," University of Nebraska Department of Horticulture, December 1967 (photocopy).

(22) Ibid.

(23) Average price for corn in Lancaster County, Nebraska Crop and Livestock Reporting Service.

(24) Tom Graff, "Major Barriers to Organic Farming," New Land Review, Spring, 1980, pg.9.

(25) United States Department of Agriculture, Estimating Livestock and Poultry Manure and Nutrient Production,

Prepared for the Economics, Statistics, and Cooperative Service by Donald L. Van Dyne and Conrad B. Gilbertson, 1978.

(26) United States Department of Agriculture, Farmer to Consumer Direct Marketing, Economic Research Service Statistical Bulletin, Number 681.

(27) United States Department of Agriculture, Vegetable Summary.

(28) Bulk Commodities Exchange: Summary Report, Department of Community Development, Seattle, Washington.

(29) Funding that may be necessary for such a producer cooperative may be obtained due to the Co-op Bank Act of 1978. It is stipulated in the Act that 300 million dollars must be allocated to producer cooperatives. Further, the Bank provides low interest subsidies, equity grants and technical assistance to cooperatives.

APPENDIX III

There are many organizations which directly or indirectly are working toward developing a sustainable food system in Nebraska. The following is a selected list of organizations working with consumers, farmers, and the food industry in Nebraska.

STATE:

American Dairy Assn. of Ne.
Sam Lewis
Daykin, NE 68338
402-466-7211

Nebr. Gasohol Committee
3rd Floor
301 Centennial Mall So.
P.O. Bx 94831
Lincoln, NE 68509
402-471-2941

Mid-America Dairymen, Inc.
W.J. Grant
319 N. 72nd St.
Omaha, NE 68114
402-556-0908

Ne. Allied Poultry Ind.
Doyle Free
211 Mussehl Hall
Univ. of Nebr.
Lincoln, NE 68583
402-472-2051

Ne. Beef Ind. Develop. Board
Steve Dittmer
P.O. Bx 520
Gibbon, NE 68840
308-468-5451

Ne. Non-Stock Sugarbeet
Growers Assn.
Ray Lind
RR 1
Lyman, NE 69352

Ne. Corn Growers Assn.
Bob Bettger
Fairmont, NE 68354
402-268-3101

Nebr. Dairy Herd Improvement Assn.
(NDHIA)
Tom Brubaker
Holmesville, NE 68374
402-228-0391

Nebr. Poultry Ind., Inc.
Doyle Free
211 Mussehl Hall
Univ. of Nebr.
Lincoln, Ne 68583-0820
402-472-2051

Nebr. Registered Sheep Breeders Assn.
Ted Doane
211 Marvel Baker Hall
Univ. of Nebr.
Lincoln, NE 68583
402-472-3095

Nebr. Soybean Assn.
Eldon Robinson
RR 2
Randolph, NE 68771
402-337-0717

Nebr. State Dairymen's Assn.
Phil Cole
205 Marvel Baker Hall
Univ. of Nebr.
Lincoln, NE 68583
402-472-6412

Nebr. State Poultry Assn.
Robert Vaughn
Box 567
Alliance, NE 69301
308-762-4816

Nebr. Stock Growers Assn.
Roy Lilley
204 East 3rd St.
P.O. Drawer 40
Alliance, NE 69301
308-762-3005

Nebr. Turkey Federation
Doyle Free
211 Mussehl Hall
Univ. of Nebr.
Lincoln, NE 68583
402-472-2051

Nebr. Wheat Board
Dan McGuire
301 Centennial Mall So.
P.O. BOx 94912
Lincoln, NE 68509
402-471-2358

Nebr. Wheat Growers Assn.
Alan Bricker
P.O. BOx 57
Ogallala, NE 69153
308-284-6823

Nebr. Wool Growers Assn.
Maynard Jensen
P.O. Box 523
Aurora, NE 68818
402-694-3219

Nebr. Egg Council
Doyle Free
211 Mussehl Hall
Univ. of Nebr.
Lincoln, NE 68583
402-472-2051

Nebr. Grain Producers Assn.
Earl Strong
1620 10th St.
Aurora, NE 68818
402-694-2726

Nebr. Grain Sorghum Devel.
Utilization and Marketing Board
c/o Barbara Kliment
301 Centennial Mall So. 4th Fl.
P.O. Box 94982
Lincoln, NE 68509
402-471-2341, Ext. 251

Nebr. Grain Sorghum Prod. Assn.
Ron Saylor
Campbell, NE 68932
402-756-1175

Nebr. Honey Producers Assn.
Howard Halbgewachs
RR 2
Cozad, NE 69130
308-784-4320

Nebr. Inter-breed Dairy Council
C. W. Nibler
98 Trenridge Way
Lincoln, NE 68505
402-466-2795

Nebr. Livestock Breeders & Feeders Assn.
Paul Guyer
204 Marvel Baker Hall
Univ. of Nebr.
Lincoln, NE 68583
402-472-6414

Nebr. Livestock Feeders Assn.
Paul Johnston
1620 M. Suite 1
Lincoln, NE 68508
402-474-5515

Nebr. Pork Producers Assn. Inc.
Terry Schrick
112 Mussehl Hall
Univ. of Nebr.
Lincoln, NE 68583
402-472-2563

Nebr. Poultry Improvement Assn.
Doyle Free
211 Mussehl Hall
Univ. of Nebr.
Lincoln, NE 68583
402-472-2051

Nebr. Cooperative Extension Service
204 Miller Hall
Univ. of Nebr.
Lincoln, NE 68583

Small Farms Action Group
PO Box 80729
Lincoln, NE 68501

Center for Rural Affairs
PO Box 405
Walthill, NE 68067

Potato Certification Assn. of Nebr.
Gary Leever
415 Black Hills Ave.
Alliance, NE 69301
308-762-1674

Sandhills Cattle Assn.
Linda Garwood
527 N. Valentine
Valentine, NE 69201
308-376-3163

Nebr. Alfalfa Dehydrators Assn.
Howard Elm
1001 Terminal Bldg.
Lincoln, NE 68508
402-475-7549

Nebr. Assn. of Fair Managers
Orville Koch
Syracuse, NE 68446
402-269-2527

Nebr. Assn. of Resources Districts
Lee Orton
P.O. Box 81310
Lincoln, NE 68501
402-474-3383

Nebr. Auctioneers Assn.
Larry Hammer
2501 S. 74th St.
Lincoln, NE 68506
402-483-7333

Nebr. Aviation Trades Assn.
Phil Marvin
1730 Skyline Dr.
LIncoln, NE 68506
402-489-9143

Nebr. Cooperative Extension Assn., Inc.
Douglas Duey
204 Miller Hall
Univ. of Nebr.
Lincoln, NE 68583
402-472-3674

Nebr. Council on Public Relations for Agriculture
Box 81353
Lincoln, NE 68501
402-472-3006

Nebr. Crop Improvement Assn.
Dennis Thompson
266 Plant Sciences Hall
Univ. of Nebr.
Lincoln, NE 68583
402-472-1444

Nebr. Farm Safety Council
Rollin Schneider
223 Agricultural Eng. Bldg.
Univ. of Nebr.
Lincoln, NE 68583
402-472-3951

Nebr. Fertilizer and Ag-Chemical Institute
Robert L. Anderson
6120 M Street.
Lincoln, NE 68508
402-476-1258

Nebr. Flying Farmers and Ranchers Assn.
Twila Neben
Star Rt. Box 62
Lexington, NE 68850
308-324-3545

Nebr. Grain and Feed Dealers Assn.
Robert L. Anderson
1620 M St.
Lincoln, NE 68508
402-476-1258

Nebr. Grain Improvement Assn.
Duane Foote
344 A. Keim Hall
Univ. of Nebr.
Lincoln, NE 68583
402-472-1540

Nebr. Home Economics Assn.
Sue Smith
6500 Pioneers Blvd.
Lincoln, NE 68506
402-488-1888

Nebr. Home Economics Assn. for Organized Agriculture
Roberta Sward
Rm. 213, Ag Hall
Univ. of Nebr.
Lincoln, NE 68583
402-472-2965

Nebr. Independent Crop Consultants Assn.
Phil Marvin
1730 Skyline Dr.
Lincoln, NE 68506
402-489-9143

Nebr. Land Imp. Contractors Assn.
Bill Hartmann
Garland, NE 68360
402-588-2286

Nebr. Livestock Markets Assn. Inc.
Gary Schnell
2418 S. 153
Omaha, NE 68144

Nebr. Pest Control Assn.
Aderin Justus
1341 Iowa St.
Fremont, NE 68025

Nebr. Petroleum Council
Vincent Brown
Box 95063
Lincoln, NE 68508
402-477-4449

Nebr. Petroleum Marketers, Inc.
George L. Watters
1320 J St.
Lincoln, NE 68508
402-474-6691

Nebr. Rural Electric Assn.
Rex Carpenter
800 S. 13th
P.O. Box 82048
Lincoln, NE 68501
402-475-4988

Nebr. Rural Radio Assn.
Eric Brown
Radio Station KRVN
Lexington, NE 68850
308-324-2371

Nebr. Seedsmen Assn. Inc.
Tim Fick
2311 Viking Ct.
Grand Island, NE 68801
308-384-5216

Nebr. Chapter of the American
Society of Farm Managers and
Rural Appraisers
Larry Bitney
Rm. 224, Filley Hall
Univ. of Nebr.
Lincoln, NE 68583
402-472-2047

Nebr. SPF Swine Accrediting
Agency, Inc.
Thomas Socha
105 Veterinary Basic Science Bldg
Fair Street, East Campus Loop
Lincoln, NE 68583
402-472-3818

Nebr. State Fair Board
State Fairgrounds
PO Box 81223
Lincoln, NE 68509
402-474-5371

Nebr. State Irrigation Assn.
Harlin Welch
546 N. Walnut
Ainsworth, NE 69210
402-387-1237

Nebr. Veterinary Medical Assn.
Bob Garey
Assn. Bldg
Ninth and Minnesota
Hastings, NE 68901
402-463-4704

Nebr. Vocational Agriculture Assn.
Dr. Osmund Gilbertson
302 Ag Hall
Univ. of Nebr
Lincoln, NE 68583
402-472-2807

Nebr. Water Conference Council
William Powers
310 Agricultural Hall
Univ. of Nebr.
Lincoln, NE 68583
402-472-3305

Nebr. Water Resources Assn.
Jack Odgaard
512 S. 13th St.
Lincoln, Ne. 68508
402-474-3242

Nebr. Well Drillers Assn.
Dick Grosch
Rt. 1 Bx 77J
O'Neill, NE 68763

Safety Council of Nebraska
5600 Valley Rd.
Box 30578
Lincoln, NE 68503
402-483-2511

Office of Policy Studies
Center for Great Plains Studies
1213 Oldfather Hall
Lincoln, NE 68588-0314

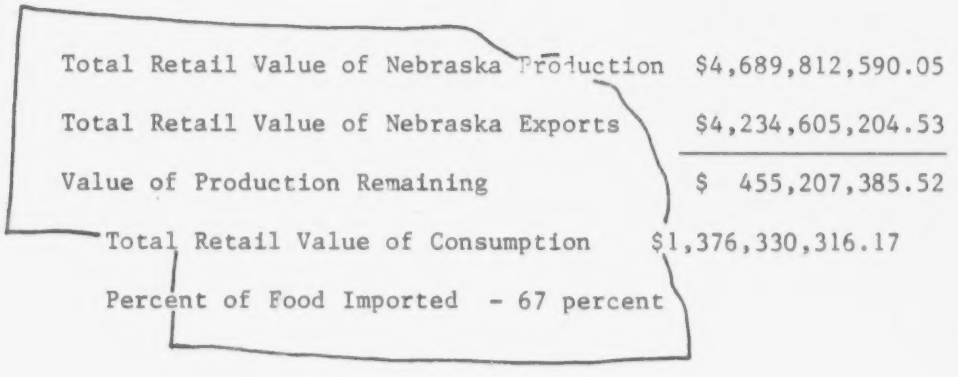
APPENDIX IV

INTRODUCTION TO FOOD IMPORTS CHART

There is little doubt that agriculture is Nebraska's largest industry. Nebraska is a leader in the production of corn, hogs, beef cattle and beans, and is a major producer of many other agricultural products. Twenty-one percent of all Nebraskans are employed on farms and in food related industries.

Despite this obvious productivity, there are weaknesses in our food system. Sixty-seven percent of the food consumed in Nebraska is imported from other states and countries. Food imports cost the consumer dollars and nutritional quality, and deprive the state of valuable economic activity. Erosion robs Nebraska farmland of over 100 million tons of topsoil each year. The soil that is blown or washed from Nebraska's farmland carries with it 49 million pounds of nitrogen and 12 million pounds of phosphorus - nutrients that are essential for good crop production.

Nebraska possesses some of the most fertile agricultural land in the country and thus has the potential to develop a food and agriculture system that provides consumers with an abundant supply of fresh nutritious food, provides farmers with a stable income and provides the state with additional economic activity in food and agriculture related industries.


Total Retail Value of Nebraska Production $4,689,812,590.05
Total Retail Value of Nebraska Exports $4,234,605,204.53
Value of Production Remaining $ 455,207,385.52
Total Retail Value of Consumption $1,376,330,316.17
Percent of Food Imported - 67 percent

NEBRASKA FOOD IMPORTS

FOODS	RETAIL WEIGHT OF PRODUCTION (1,000 lbs.)	RETAIL VALUE OF PRODUCTION ($1,000)	RETAIL WEIGHT OF CONSUMPTION (1,000 lbs.)	RETAIL VALUE OF CONSUMPTION ($1,000)	IMPORTS PERCENT	RETAIL VALUE OF IMPORTS ($1,000)	EXPORTS PERCENT	RETAIL VALUE OF EXPORTS ($1,000)	RETAIL WEIGHT OF EXPORTS (1,000)	ACRES NECESSARY* TO PRODUCE 100 % OF CONSUMPTION
MEATS										
Beef and veal	1,175,164,200.00	2,808,642,438.00	122,407.00	292,552,730.00			89.00	2,668,210,316.10	1,045,896,138.00	301,866.83
Lamb/mutton	5,131,620.00	6,980,335.00	2,219,000.00	3,883,250.00			81.00	7,274,071.35	4,156,612.20	4,661.76
Pork	710,360,300.00	1,669,346,705.00	103,063,000.00	157,686,390.00			90.00	1,502,412,034.50	639,324,270.00	216,518.91
POULTRY										
Chicken	4,395,600.00	5,450,544.00	81,974,000.00	101,647,760.00	94.64	93,515,939.20				52,149.63
Turkey	10,825,600.00	10,067,808.00	16,965,000.00	15,777,450.00	36.19	3,155,490.00				61,201.30
Eggs	98,750,000.00	52,337,500.00	53,275,000.00	28,235,750.00			46.00	24,075,250.00	45,425,000.00	72,834.78
FLUID MILK	1,400,000.00	1,288,000.00	312,200,000.00	287,224,000.00	99.55	284,351,760.00				86,109.89
FRESH VEGETABLES										
Artichokes	NC		792,792.00	2,584,501.92	100.00	2,584,502.00				NA
Asparagus	80,000.00	125,600.00	475,675.00	746,809.75	100.00	746,809.00				118.94
Broccoli	29,400.00	14,994.00	3,012,611.00	1,536,431.61	99.20	1,533,358.75				273.83
Cabbage	20,040.00	5,611.20	12,050,466.00	3,374,130.48	99.80	3,340,389.18				573.82
Carrots	44,088.00	14,108.16	9,989,185.00	3,196,539.20	99.50	3,164,573.81				285.38
Cauliflower	11,250.00	7,762.50	2,695,494.00	1,859,890.86	99.40	1,841,291.95				1,792.81
Celery	NC		11,416,212.00	3,881,512.08	100.00	3,881,512.00				NA
Cucumbers	456,855.00	191,879.10	6,500,898.00	2,730,377.16	93.00	2,539,250.76				1,354.34
Eggplant	92,000.00	71,760.00	792,792.00	618,377.76	88.40	544,172.43				79.29
Garlic	NC		951,351.00	2,606,701.74	100.00	2,606,702.00				59.43
Green peppers	29,700.00	26,136.00	5,073,872.00	4,465,007.36	99.40	4,420,357.29				253.72
Lettuce	22,242.00	7,784.70	37,736,923.00	13,207,923.05	99.90	13,075,843.82				1,078.20
Onions	944,673.00	245,614.98	14,587,382.00	3,792,719.32	93.50	3,527,228.97				486.26
Potatoes	17,142,210.00	3,942,708.30	74,681,006.00	17,176,631.47	77.00	13,226,006.23				3,930.58
Snap beans	1,167,500.00	945,675.00	1,061,260.00	859,620.60			9.00	85,110.75	105,075.00	212.24
Spinach	NC		1,268,468.00	875,242.92	100.00	875,242.00				256.17
Sweet corn	10,590,863.00	4,659,979.72	10,306,302.00	4,534,772.88			2.00	93,199.59	211,817.26	3,170.68
Tomatoes	1,340,360.00	643,372.80	17,917,110.00	8,600,212.80	92.50	7,912,195.78				895.86

*Acreage required to produce 100 percent of Nebraska consumption

NC - Data not collected

NA-Not applicable to Nebraska

NEBRASKA FOOD IMPORTS

FOODS	RETAIL WEIGHT OF PRODUCTION (1,000 lbs.)	RETAIL VALUE OF PRODUCTION ($1,000)	RETAIL WEIGHT OF CONSUMPTION (1,000 lbs.)	RETAIL VALUE OF CONSUMPTION ($1,000)	IMPORTS PERCENT	RETAIL VALUE OF IMPORTS ($1,000)	EXPORT PERCEN	RETAIL VALUE OF EXPORTS ($1,000)	RETAIL WEIGHT OF EXPORTS (1,000)	ACRES NECESSARY* TO PRODUCE 100 Z OF CONSUMPTION
VEGETABLES (canned and frozen)			475,675.20	680,215.54	100.00	680,215.00				64.81
Asparagus	NC		1,902,700.80	703,999.30	100.00	703,999.00				73.78
Beets	NC		2,373,376.00	469,015.75	100.00	469,015.00				180.31
Broccoli	NC		459,819.36	418,435.62	100.00	418,435.00				NA
Brussels sprouts	NC		1,649,007.36	1,137,815.08	100.00	1,137,815.00				30.69
Carrots	NC		887,927.04	1,038,874.64	100.00	1,038,875.00				49.33
Cauliflower	NC		792,792.00	705,584.88	100.00	705,584.00				NA
Lima beans	NC		2,457,655.20	2,039,853.82	100.00	2,039,854.00				496.08
Peas	NC		11,733,321.60	6,570,660.10	100.00	6,570,660.00				1,577.27
Pickles	NC		1,744,142.40	1,151,133.98	100.00	1,151,134.00				42.27
Potatoes	NC		1,109,908.80	543,855.31	100.00	543,855.00				28.43
Sauerkraut	NC		1,775,854.08	1,029,995.37	100.00	1,029,995.00				233.28
Snap beans	NC		1,189,188.00	725,404.68	100.00	725,404.00				248.27
Spinach	NC		8,086,478.40	3,396,320.93	100.00	3,396,321.00				3,966.18
Sweetcorn	NC		1,427,025.60	799,134.34	100.00	799,134.00				9.58
Sweet potatoes	NC		32,345,913.60	15,202,579.39	100.00	15,202,579.00				347.12
Tomatoes	NC									
FRESH FRUITS										
Apples	1,743,690.00	1,063,650.90	31,711,700.00	19,344,137.00	94.50	18,183,488.78				2,471.07
Cantaloupe	1,476,900.00	1,831,356.00	12,526,121.00	6,137,799.29	88.60	5,401,263.38				835.05
Cherries	157,840.00	276,220.00	792,792.00	1,387,386.00	80.10	1,109,908.80				105.68
Grapes	484.00	445.28	5,073,872.00	4,667,962.24	99.70	4,621,282.62				596.91
Melons	3,719,100.00	1,636,404.00	17,599,993.00	7,743,996.92	78.10	6,040,317.60				488.86
Peaches	2,787.00	1,588.59	8,403,600.00	4,790,052.00	99.90	4,742,151.48				291.82
Pears	44,495.00	20,467.70	4,281,079.00	1,969,296.34	98.90	1,929,910.41				342.51
Plums	48,510.00	85,862.70	2,695,494.00	4,771,024.38	97.90	4,627,893.65				216.28
Strawberries	7,280.00	6,624.80	3,329,728.00	3,030,052.48	99.70	2,999,751.96				739.94

*Acreage required to produce 100 percent of Nebraska consumption

NC - Data not collected

NA-Not applicable to Nebraska

NEBRASKA FOOD IMPORTS

FOODS	RETAIL WEIGHT OF PRODUCTION (1,000 lbs.)	RETAIL VALUE OF PRODUCTION ($1,000)	RETAIL WEIGHT OF CONSUMPTION (1,000 lbs.)	RETAIL VALUE OF CONSUMPTION ($1,000)	IMPORTS PERCENT	RETAIL VALUE OF IMPORTS ($1,000)	EXPORTS PERCENT	RETAIL VALUE OF EXPORTS ($1,000)	RETAIL WEIGHT OF EXPORTS (1,000)	ACRES NECESSARY* TO PRODUCE 100 % OF CONSUMPTION
PROCESSED FRUITS										NA
Frozen fruits	NC		2,378,377.50	3,971,890.43	100.00	3,971,890.00				NA
Fruit juices	NC		20,136,929.50	28,594,439.89	100.00	28,594,440.00				NA
Canned & chilled fruits	NC		26,003,594.00	17,422,407.98	100.00	17,422,408.00				
Canned & chilled fruit juices	NC		18,392,786.00	17,473,146.70	100.00	17,473,147.00				NA
Dried fruits	NC		3,805,404.00	11,682,590.28	100.00	11,682,590.00				NA
GRAINS										5,417.00
Dried edible beans	1,700,000.00	867,000.00	6,500,898.50	3,315,458.24		2,420,284.51	73.00	2,379,963.09		422.00
Dried field peas	13,780,000.00	7,165,600.00	634,234.00	329,801.68			95.39	6,835,798.32		36,145.69
Corn	44,951,200.00	33,713,400.00	190,270,200.00	142,702,650.00	76.38	108,454,014.00				7,823.67
Oats	50,808,300.00	35,057,727.00	9,513,510.00	6,564,321.90			81.00	28,396,758.87	41,154,723.00	1,191.69
Barley	1,052,262.00	536,653.62	2,378,377.00	1,212,972.27	55.76	667,134.75				122,211.20
Wheat	69,835,900.00	32,822,873.00	183,927,860.00	86,446,094.20	62.03	53,596,578.40				
HONEY	4,880,000.00	7,710,400.00	1,585,585.00	2,505,224.30			67.00	1,678,500.28	3,269,600.00	NA
TOTALS	2,232,207,249.00	4,689,812,590.05	1,525,770,719.34	1,376,330,316.17		777,393,954.48		4,234,605,204.53	1,792,634,235.46	990,972.41

*Acreage required to produce 100 percent of Nebraska consumption

NC - Data not collected

NA-Not applicable to Nebraska

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THE CORNUCOPIA PROJECT

The Texas Food System: PROSPECTS FOR SUSTAINABILITY

BY

C. Ronald Carroll, Nan L. Terry
and Harold Freeman

FOR

The Cornucopia Project of Rodale Press

Edited by Andrea Cesari

The Cornucopia Project • 33 E. Minor Street • Emmaus, Pennsylvania 18049 • Phone: (215) 967-5171

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INTRODUCTION

An important indication of the success of the United States food system is the fact that we seldom need to think about the food system at all. The quantity, quality and variety of foods we want are generally available at our local grocery store and are reasonably priced.

This very success has blinded us to some of the weaknesses and vulnerabilities of the complex system that produces, processes, transports and sells our food. The vast productivity of the United States food system has been bought in part with non-renewable resources. Fossil fuels are used to power farm machinery, processing plants, the trucks that bring our food to the local grocery store, and the cash register at the check-out counter.

In many regions of the country, crop production has been possible only because farmers were able to mine huge underground water sources. But these aquifers, which took thousands of years to form, are being mined so intensively that it's only a matter of years before the wells start to run dry.

The nation's agricultural lands have been mined also. Many modern cropping practices have allowed precious topsoil to be washed away. Soil micro-organisms, essential to a soil's continued productivity, have been diminished by over-application of agricultural chemicals.

These are just a few of the problems facing the food system of the United States. These problems are not just the concerns of distant researchers and policy makers, they are immediate concerns that affect every state and every consumer. Some of the

problems facing Texans are:

* Almost a third of the food consumed in Texas is imported from other states and countries.

* Between 1967 and 1977 Texas lost 2,260,000 acres of agricultural land to urban, built-up, transportation and water uses.

* Each year, 1.13 billion tons of soil are eroded from Texas' crop, pasture, and rangeland -- enough to cover Dallas with 3.5 feet of soil.

* The Ogallala Aquifer, an important source of irrigation water, is being mined faster than it can recharge. By 2000, it will no longer be economical to pump the Ogallala.

This report is an attempt to put together the facts we have about the Texas food system, and show Texans the strengths and weaknesses of the state's food and agriculture system. By building on our strengths, and eliminating our weaknesses, we can develop a food and agriculture system that is productive, adaptable, and sustainable. The recommendations section of this report is designed to provide guidance for state and local governments, farmers, industry, researchers, and consumers who are concerned about making changes in their food system.

FOOD IMPORTS/EXPORTS

There is no doubt that Texas is one of this country's most important agricultural producers. The state ranks among the top ten producing states for over twenty agricultural commodities. Texas' 186,000 farms and ranches encompass over 144,518,000 acres of crop, pasture and rangeland, comprising 86 percent of the state's total land area.[1] In 1981, total cash receipts from crops and livestock came to a respectable $9,776,731,000.[2]

Yet, according to the Food Imports Chart (see Appendix II), almost a third of the food consumed by Texans is imported from other states and countries. Each year, Texas' consumers spend a total of $16,895,920,260 on food.[3] Of this total, $5,203,943,440 is spent on foods produced in other states and countries.[4] Since only about 28 percent of food expenditures for these imported foods remain with Texas' retailers, Texas is actually exporting its food dollars.[5] Each year, $3.75 billion leaves the Texas economy to pay for foods imported from other states and countries.

Some foods are imported because they can't be grown in Texas' climatic and geographic conditions -- we will always import our coffee, tea, cocoa and tropical fruits, for example. But most of the food that is imported into the state could be grown in Texas, or is already being grown in small quantities. For example, although Texas ranks sixth in the nation for production of cauliflower, 73 percent of fresh cauliflower consumption is imported from Arizona and California. And

although Texas ranks fifth in the nation for lettuce production, 78 percent of the state's lettuce consumption is imported from other states. In some cases, the state imports the same foods it exports. Although over 11 million pounds of fresh spinach were exported, 1.9 million pounds were imported into Dallas and Houston.[6]

Food imports tell only a part of Texas' agriculture story. Food exports must also be considered, for a substantial part of Texas agriculture is export-oriented. Texas produces 1.8 billion pounds of rice, 91 percent of which is exported. Exports are a critical source of income for Texas farmers and ranchers, but changing production patterns, both in this country and abroad, could bring significant changes to Texas agriculture.

FARMLAND

The total land area of Texas is just over 171 million acres, of which 3.315 million acres is water and 2.898 million acres is federally owned. Of the remaining 164.8 million acres, 88 percent is in cropland, pastureland and rangeland.[7]

Texas has approximately 37.5 million acres that are classified as prime farmland. Of that total, 17.6 million acres are actually in cropland, 5.8 million acres are in pastureland and 11.2 million acres are in rangeland. Prime farmland that is used as forestland accounts for 2.3 million acres. Texas has a sizable amount of land with high and medium potential for conversion to cropland. This amounts to about 8.5 percent of the total land area or a little more than 22 thousand square miles. This gives Texas 30.4 million acres of potential croplands for a

total cropland base of 44.7 million acres.

Rangeland condition is rated with the classifications of excellent, good, fair and poor. Rangeland in excellent condition generally produces more forage and has a lower erosion rate and higher fertility than rangeland in the other three classifications. In Texas, it is estimated that 36 percent of the rangeland is in excellent and good condition, 46 percent is in fair condition and 17 percent of the state's rangeland is in poor condition.[8]

Farmland is not an unlimited resource, and a state's agricultural production capabilities can be diminished by development on agricultural land. It is estimated that between 1967 and 1977, Texas lost 2,260,000 acres of agricultural land to urban, built-up, transportation and water uses.[9] The amount of land that is lost in one year is enough to grow all of Texas' consumption of fresh cauliflower, sweet corn, eggplant, garlic, spinach and broccoli.

FARMS AND FARMERS

In 1981, Texas had 186,000 farms.[10] According to the U.S. Census Bureau, a farm is any place which sells, or could sell $1,000 in agricultural products. This definition overlooks small and some part-time farms, which generally provide food for local consumption. These small operations can be an important part of Texas' local and regional economies.

As of 1978, approximately two-thirds of Texas farms were family owned, while one-quarter were owned by partnerships, and 9 percent were owned by corporations.[11] About half of the farm

operators in Texas work more than 100 days in occupations off the farm.[12] Nearly three-quarters of the farm operators in Texas are 45 years old or older.[13] This large number of older farmers may indicate that younger people consider farming a risky, unprofitable occupation, with prohibitively high start-up costs. A modest 300 acre farm in Texas would cost a new farmer $172,800 just for the land and buildings.[14] Equipment, seed, livestock and other inputs would increase these costs.

There is a sharp division in the average size of farms between the western half of Texas and the eastern half of the state. West Texas has a high concentration of farms in excess of 3,000 acres while the eastern half of the state consists largely of farms less than 300 acres in size. Racial minority groups tend to own farms that are smaller than average. The "average" farm in the state in 1978 was over 700 acres. Those with operators of Spanish origin averaged 423 acres while those with Black operators averaged 387 acres.

A 1982 report of the United States Commission on Civil Rights entitled "The Decline of Black Farming in America"[15] pointed out that by the late 1970's, the rate of farm loss for blacks was 2.5 times the loss for whites. Curiously, the boll weevil has played a role in this devastating rate of farm loss. In cotton lands, especially in Alabama, during World War I, the bottom fell out of the cotton market. Emergency credit was extended and cotton storage was provided, but mostly for white farmers. For example, Asa G. Candler, Atlanta millionaire and director of the Coca-Cola Company, offered low-interest loans and

storage facilities for one-quarter of a million bales of cotton to white planters. Blacks had difficulty getting credit for anything but cotton cultivation.

In the years following the first World War, the boll weevil spread throughout the South, reducing cotton yields. During this period, with their easier access to credit, white farmers borrowed heavily to keep their land. They began to make purchases for cattle and for diversification of their crops in order to decrease their dependence on cotton. As a result, many more blacks, with their increasing debt loads and dwindling sources of credit, were left few alternatives to farm abandonment.

The report also argues that the Farmers Home Administration (FmHA) systematically discriminates against blacks. For example, in Texas in 1979 there were 33 black FmHA committee members. By 1980 this had declined 45 percent. Blacks received only approximately 2.5 percent of the total dollar amount loaned through the farm-credit programs in the fiscal year of 1981.

Texas also has significant amounts of foreign farmland ownership.[16] While the total percentage acquired by foreigners as of 1981 amounted to only 0.6 percent of the land area, this amounted to nearly 800 thousand acres. In some counties, particularly the citrus-growing counties, foreign ownership tends to be more concentrated. Hidaldo County, for example, has nearly 15 percent of its land area under foreign ownership. In Cameron County, another citrus area, foreign-owned land amounts to over $21.5 million. As one would expect, this is high value investment land. The average purchase price per acre of foreign

owned land in Cameron County was nearly $2,000.00, while the state average in 1981 was $492.00 per acre. Since the majority of the foreign land purchases in Cameron County took place in the mid-1970's, we expect that the land would be considerably more valuable today. Although current land values for Cameron County are not available, average per acre value was estimated as follows: In 1978, the most recent year with complete census data, Cameron County land was approximately 2.5 times as valuable as the state average. We therefore took the 1981 state average per acre value of $492.00 and multiplied by a conversion factor of 2.5 to give an estimated per acre value for Cameron County land of $1,220.

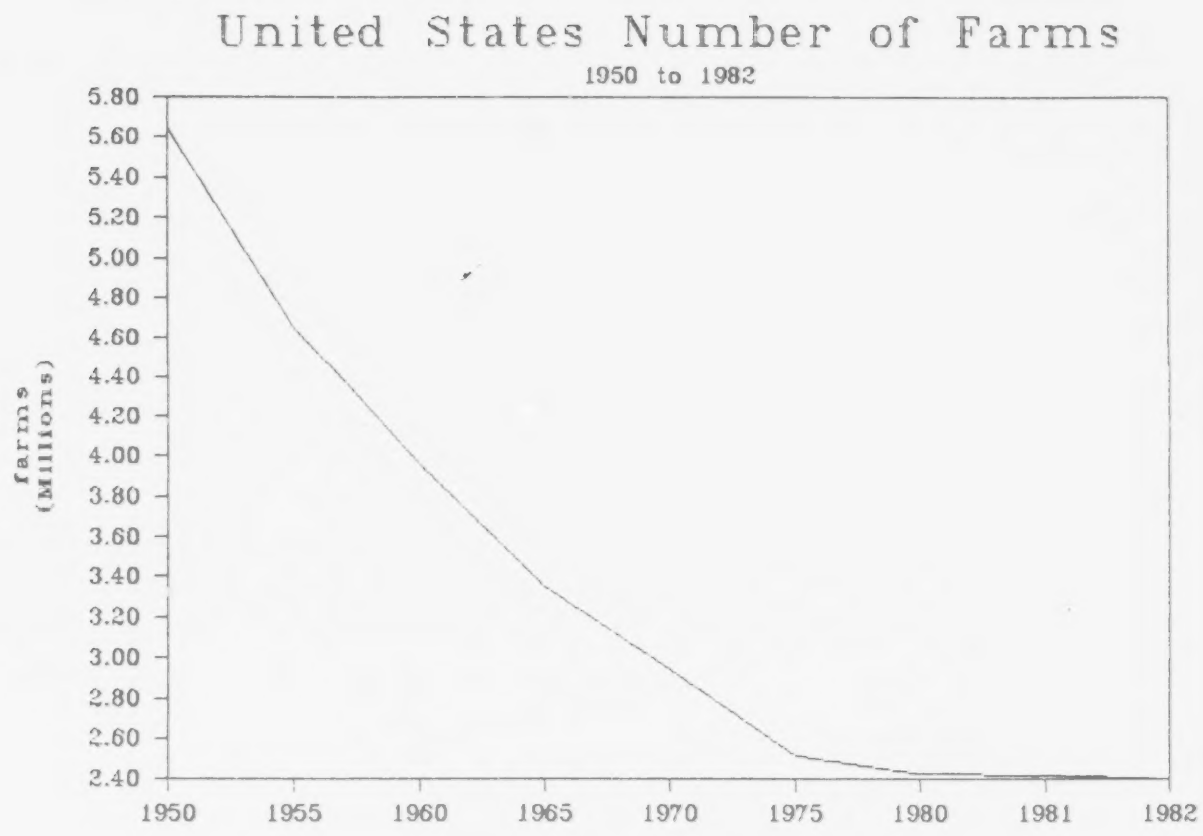
Figures 1 and 2 show the historical pattern for the decline in the number of farms in Texas and in the United States. Also, the amount of land in farms is illustrated. The patterns illustrated for the state of Texas are similar to the patterns for the United States. As a whole, however, the trends in Texas appear more accelerated.

SOIL EROSION

Agriculture is impossible without well-maintained soils. Good agricultural soils contain the correct balance of nutrients, trace minerals, organic matter and water. Formation of these topsoils requires hundreds of years; destruction can occur in a single growing season.

Erosion by wind and water can have devastating effects on topsoil. Soil is physically removed by the action of water and wind, only to be deposited in less desirable locations. Organic

Figure 1


United States Number of Farms
1950 to 1982
farms (Millions)
5.80
5.60
5.40
5.20
5.00
4.80
4.60
4.40
4.20
4.00
3.80
3.60
3.40
3.20
3.00
2.80
2.60
2.40
1950
1955
1960
1965
1970
1975
1980
1981
1982

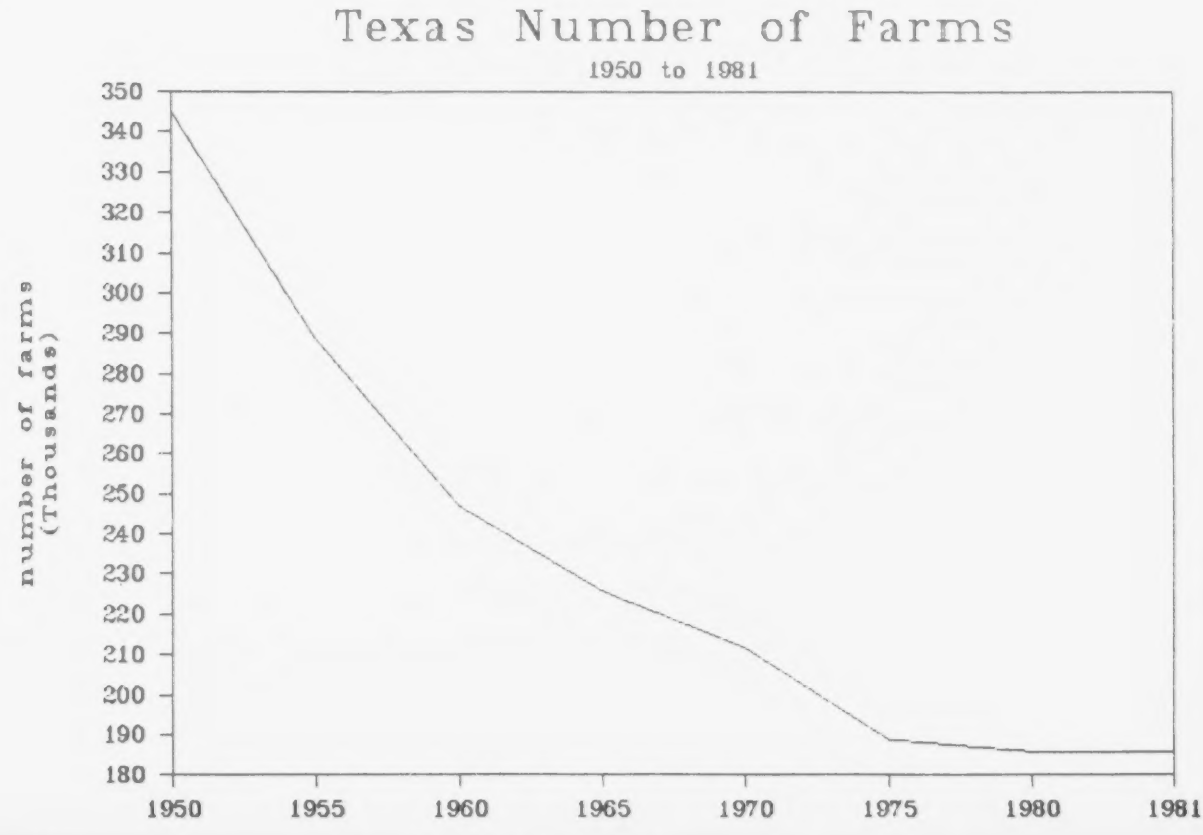
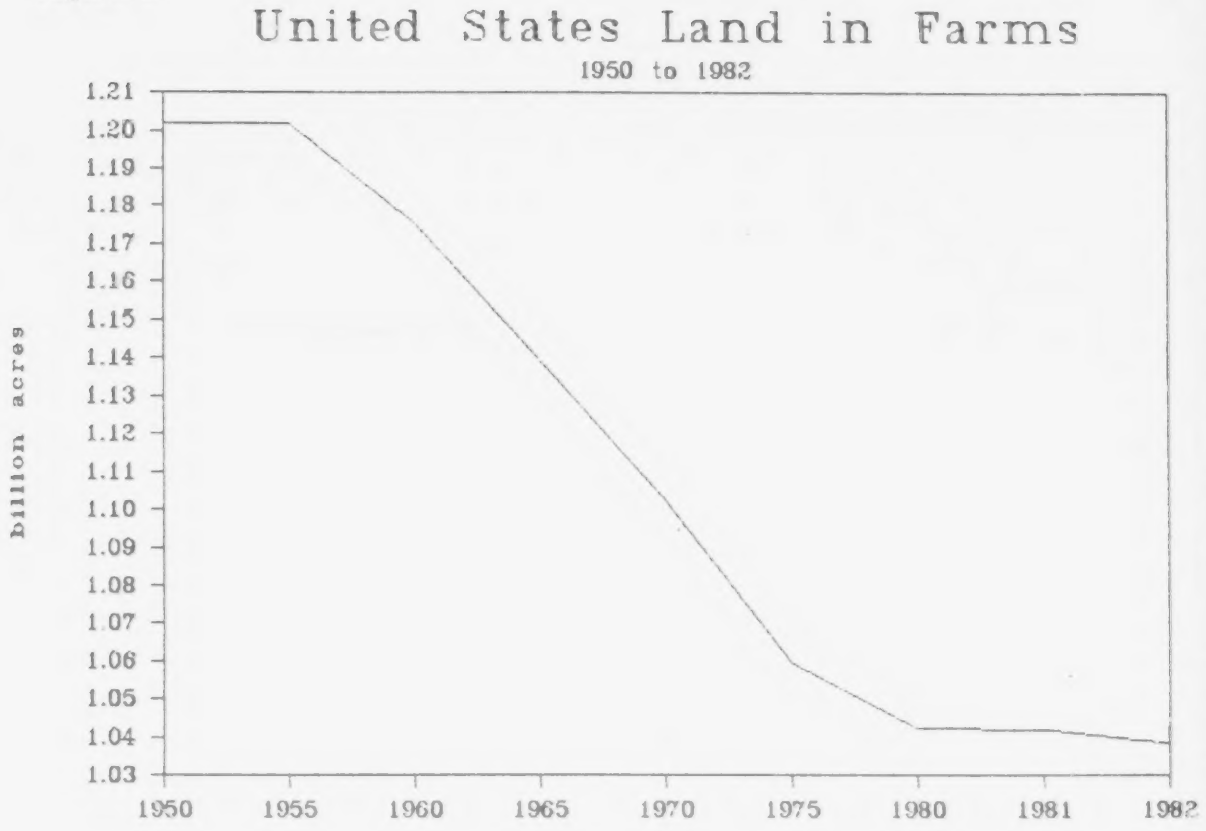
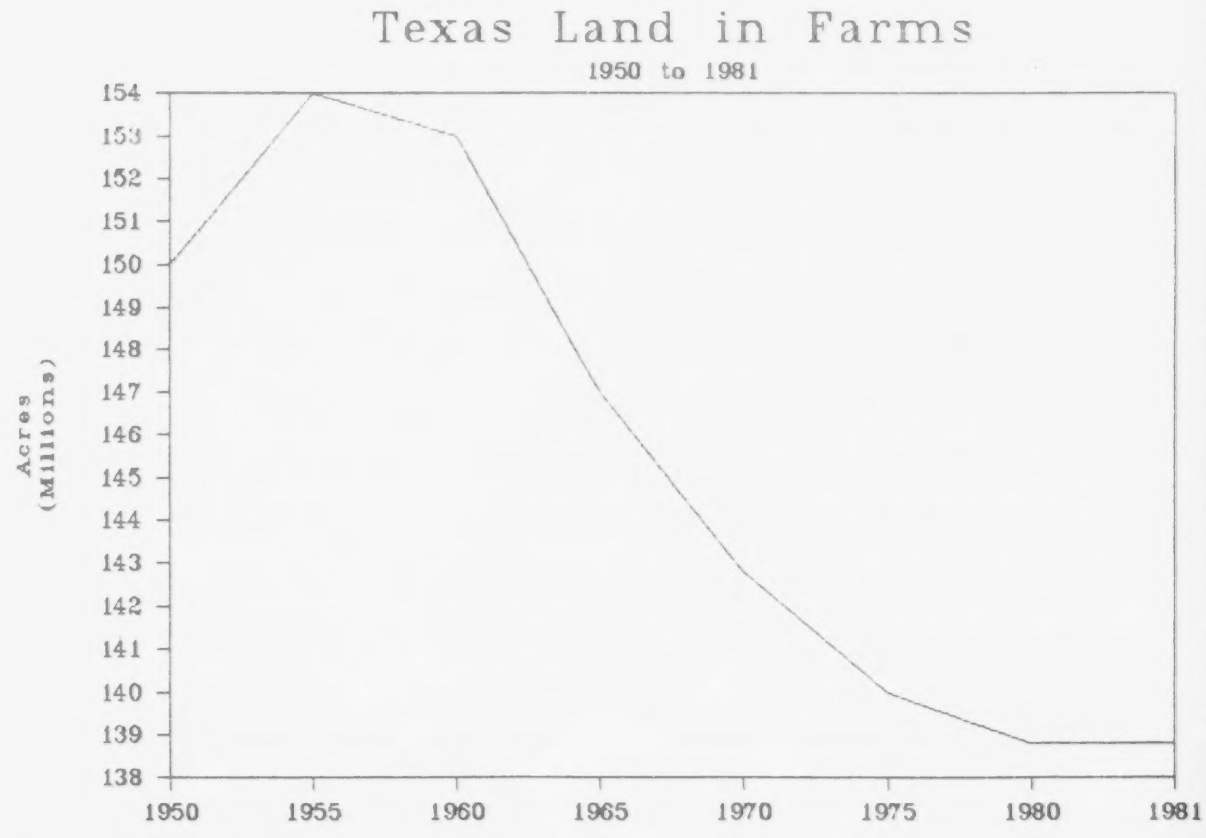

Texas Number of Farms
1950 to 1981
number of farms (Thousands)
350
340
330
320
310
300
290
280
270
260
250
240
230
220
210
200
190
180
1950
1955
1960
1965
1970
1975
1980
1981

Figure 2


United States Land in Farms
1950 to 1982
billion acres
1.21
1.20
1.19
1.18
1.17
1.16
1.15
1.14
1.13
1.12
1.11
1.10
1.09
1.08
1.07
1.06
1.05
1.04
1.03
1950
1955
1960
1965
1970
1975
1980
1981
1982


Texas Land in Farms
1950 to 1981
Acres
(Millions)
154
153
152
151
150
149
148
147
146
145
144
143
142
141
140
139
138
1950
1955
1960
1965
1970
1975
1980
1981

matter and nutrients are leached out of the soil by water erosion.

Agricultural land that is losing less than five tons of soil per acre will probably maintain itself and keep crop production levels consistently high. Soil losses of over five tons per acre will eventually lead to reduced crop yields, until it is no longer profitable for farmers to grow their crops on these badly eroded lands. Restoring land to its optimal productivity is a lengthy and expensive process.

In Texas, erosion due to wind and water ranges from .34 tons per acre on forestland to over 17 tons per acre on cropland.[17] All told, 1.13 billion tons of soil are eroded from Texas crop, pasture, range and forest land each year. This is enough soil to bury the city of Dallas to a depth of 3.5 feet.[18]

This soil carries with it valuable nutrients and water. The soil that is eroded from Texas cropland contains the equivalent of 13.4 million tons of nitrogen and phosphorus fertilizer, valued at $2.88 billion.[19] By way of comparison, Texas' consumption of these nutrients in 1981 was equivalent to 2.4 million tons of nitrogen and phosphorus fertilizers, worth $512 million.[20] Soil also contains water. The soil that was eroded from Texas' agricultural land took with it 32 billion gallons of available water.

Contour plowing is frequently recommended as a simple and inexpensive way to reduce erosion losses.[21] Contour plowing and planting may save farm energy since some reports suggest that less tractor time and fuels may be required. However, intense

storms may create runoff that breaks through the contour ridges and may lead to severe gully erosion. In Texas, the use of terraces to prevent erosion is widespread, but there are trade-offs. More machine time and energy use is required since cultivation patterns have to be fitted in between the terraces. Also, while the use of terraces decreases erosion, their very effectiveness contributes to water-logging problems. This is especially true in clay soils. In these circumstances, root diseases and soil nitrogen losses can become substantial.

Alternating strips of crops that are vulnerable to erosion with crops such as hay that are less vulnerable is a potentially useful way to reduce erosion. Such strip-cropping practices may also be developed in such a way as to reduce pest losses as well. For example, it is a common practice in some regions to strip-crop cotton with alfalfa. Leaf-hopper insects which damage cotton actually prefer alfalfa. Since the economic damage threshold is much higher in alfalfa than it is in cotton, this practice effectively makes alfalfa a trap crop for this insect and reduces damage to cotton.

Crop rotation can also reduce long-term erosion losses. This is especially true when grasses are alternated with row crops. In Texas the common practice of planting winter wheat to alternate with a summer crop is an important erosion control practice.

In recent years, a practice referred to as no-till agriculture has been promoted. These are really programs to minimize the extent of soil cultivation through increasing application of herbicides for weed control. These practices

contribute to erosion control because they result in more stubble and crop residue remaining in the fields. The trade-off, of course, is that often more chemical herbicides are required, and it is not yet known what the long-term effects on soil organisms might be.

In general, techniques that reduce water erosion will also tend to reduce wind erosion. In addition, the use of wind breaks can be incorporated to reduce wind erosion. During a severe wind a tree will significantly reduce erosion on its leeward side for a distance somewhat in excess of ten times its height. The physical effect of a windbreak is to convert laminar flow of air across the field into a slower turbulent flow. Not only will this tend to reduce erosion, but it will also tend to reduce evaporation. Thus, wind breaks also contribute to the effective recharging of soil moisture. An obstacle to the development of wind breaks is the widespread practice of using large farm machinery. Wind breaks are effective when fields are narrow. However, with high land costs and large tractors and field equipment, the tendency is to plant very wide fields. Thus, the somewhat artificial economies of scale that have been created by the agricultural engineering departments of our land grant institutions act to preclude the use of some effective resource conservation practices.

WATER

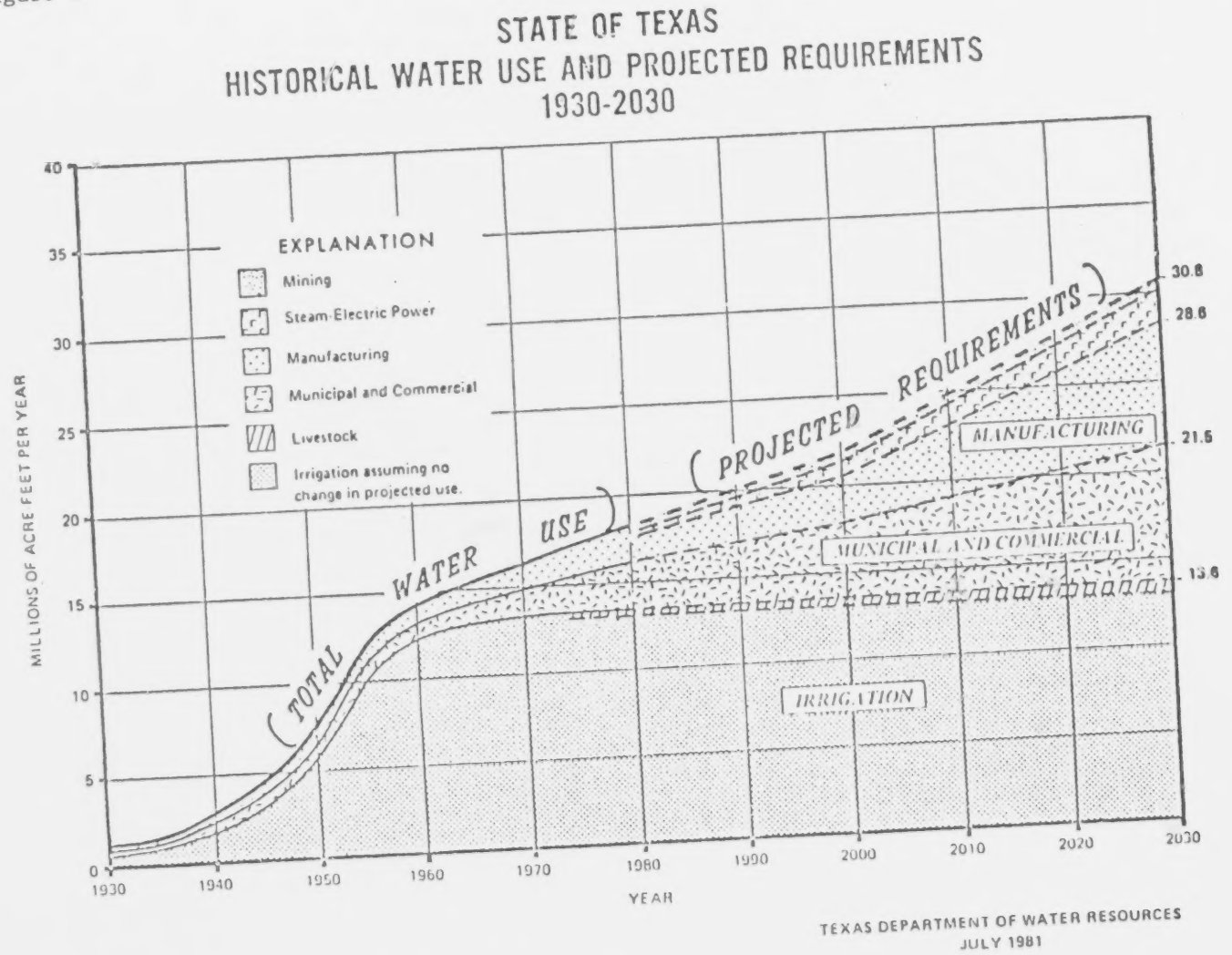
Except for the eastern-most third of the state, Texas' agriculture requires large quantities of water for irrigation purposes. Approximately 17.3 million acre-feet of

water are withdrawn in Texas every year. Of that total, irrigated agriculture withdraws more than three quarters; 2.7 million acre-feet of surface water are withdrawn for irrigated agriculture, while 10.4 million acre-feet of ground water are used for agriculture.[22] For most of this ground water use, the rates of recharge are so low as to effectively result in a mining of ground water supplies. The most important ground water supply is that of the Ogallala Aquifer, which underlies most of the High Plains.[23]

Figure 3 illustrates the historical pattern of water use and projected requirements in Texas. It can be seen that while irrigation remains the largest single user of water supplies, other users such as municipal and commercial and manufacturing will increase their proportional share. This pattern raises a potential user conflict between agriculture and industry. The state's manufacturing production is approximately 77 billion dollars with over 200 major water-using industries in Texas. The value of agriculture production is approximately 6.9 billion dollars annually.[24] In general, the value added to production from the use of water increases much more in industry than in agriculture. Therefore, if conflict over water use is resolved in a free market arena, agriculture might lose.

Irrigation is currently critical to the performance of Texas agriculture. Since the early 1970's, irrigation of about one-third of the state's cropland has produced between 50 and 65 percent of the total annual value of harvested crops. For every dollar of production from irrigated farming, approximately $3.70

Figure 3


STATE OF TEXAS
HISTORICAL WATER USE AND PROJECTED REQUIREMENTS
1930-2030
EXPLANATION
Mining
Steam-Electric Power
Manufacturing
Municipal and Commercial
Livestock
Irrigation assuming no change in projected use.
TOTAL WATER USE
PROJECTED REQUIREMENTS
MANUFACTURING
MUNICIPAL AND COMMERCIAL
IRRIGATION
30.8
28.6
21.5
15.6
MILLIONS OF ACRE FEET PER YEAR
0
5
10
15
20
25
30
35
40
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
2030
YEAR
TEXAS DEPARTMENT OF WATER RESOURCES
JULY 1981

is generated throughout the economy for agricultural supplies. An additional $2.50 is generated per dollar of agricultural production to the general economy from marketing and processing agricultural commodities.

Water used in Texas comes from ground water sources in twelve major irrigation districts throughout the state. It is clear that Texas irrigated agriculture can not be sustained at current levels without developing additional water sources and/or implementing water conservation practices. According to the Texas Department of Water Resources, pumping of ground water in the 1980's is now exceeding the ability of the state's aquifers to recharge.

The demand for ground water is expected to increase sharply in the near future since population projections show that Texas is the country's fastest growing state, with a population that will exceed 21 million people by the year 2000. Only the eastern-most portion of the state has adequate water supplies and this has given rise to numerous proposals to construct a massive water transfer system that would move water from the wet regions of east Texas and parts of Arkansas and Louisiana to the arid regions of west Texas and the High Plains.[25] While these water transfer schemes have a certain appeal as an engineering design on paper, they have enormous problems in reality.[26]

There are three major limitations to current irrigation practices. These are ground water depletion rates, the associated cost of acquiring the water, and the environmental consequences as salt concentration increases over time. The depletion problem is most acute in the High Plains region where

Figure 4

Ogalla Aquifer-Texas
Thickness of water-bearing strata (feet)
0= no significant water-bearing strata
1= 100-400 feet thickness
2= 400-12,000 feet thickness

declining water supplies from the great Ogallala Aquifer (Fig. 4) have become critical. Agriculture in the High Plains regions is heavily dependent upon ground water for irrigation, and since this region contributes nearly half of the state's total agricultural value, the problem is indeed serious. The Texas Department of Water Resources has published a series of county analyses of the well yields from the Ogallala Aquifer.[27] The reports include a projection of well yields for the year 2000 and, in general, these projections indicate that well yields will be too low to economically support irrigated agriculture.

As ground water must be pumped from ever-increasing depths, the energy cost of acquiring water will greatly increase. Currently, energy from natural gas and electricity supplies much of the energy for pumps. According to a recent study sponsored by the Texas Energy and Natural Resources Advisory Council,[28] the price of natural gas in Texas is expected to more than double by the year 1990. In one study involving two counties, the average cost of electricity to supply ten inches of water for cotton production was $64.47 per acre. A quick look at the cost effectiveness suggests that the energy costs were not worth the difference in yields. For the two counties, Upton and Glasscock, the difference between irrigated and non-irrigated upland cotton is 81 and 47 pounds per acre respectively. Thus, if we take as a reasonable price for cotton 55 cents per pound, then the added value of irrigation for Upton County was $44.55, and for Glasscock County, $25.85. Given that the average seasonal cost for irrigation water was $64.47 per acre, the

difference shows an average loss of $19.92 for Upton County, and $38.62 for Glasscock County. In this case, irrigation resulted in a net operating loss for the cotton growers.

There are at least two major environmental costs associated with intensive irrigation practices. The first is land subsidence. When water is withdrawn at a rate much in excess of the recharge rate, the empty pore spaces can become compacted. The result is the common scene in irrigated regions where wells protrude from the ground and telephone poles appear to grow year by year as the land sinks around them. The second problem is an increase in salts resulting from excessive evaporation of irrigation water. While the problem exists in the more arid portions of Texas, it has not yet reached the proportions that occur in southern Arizona and parts of southern California. Since the principal solution to salt build-up is to greatly increase the flow of water, the shortage of water in Texas would seem to preclude this approach. Thus, salt build-up in Texas irrigated agriculture may require expensive remedies.

AGRICULTURAL ENERGY[29]

United States agriculture is energy intensive, and Texas is no exception. There is a strong interest among Texas farmers to reduce energy consumption. The concern has been stimulated by the rapidly rising costs of all forms of energy. The U.S. Department of Energy has estimated that while a doubling of energy prices would increase raw commodity prices by only thirteen percent, a ten percent energy reduction or shortage would lead to a 55 percent increase in raw commodity prices.

Since 1977 the price paid for fuels and energy has risen much faster than any other farm cost item. While agriculture in Texas is energy intensive, it still consumes somewhat less than 10 percent of the total energy used in the state.

Farmers are currently heavily dependent on the national and international petroleum market for their energy needs. However, farmers are in an unusual position because they have considerable potential for becoming energy self-sufficient. Agricultural residues in the form of cotton-gin trash, corncobs, cornstalks, sorghum material, animal manure, and other organic residues may be converted into such usable energy sources as methanol and ethanol for fuel, burnable methane gas, or they can be burned directly. Given this potential, it becomes important to understand that a farm is a system which produces food and which both consumes and produces usable energy.

Texas Tech University and Texas A & M University have made major contributions in the development of farm energy technologies. The Texas Farmers Union has been very supportive of the development of such technologies, especially the development of alcohol stills for the production of fuel ethanol. The Texas Energy and Natural Resources Advisory Council developed a comprehensive plan for alcohol fuels development in Texas in 1980. The various subsidies that exist to encourage use of alcohol as an additive to unleaded gasoline continue to create a favorable market for alcohol yielding crops in Texas. Currently, corn is the leading contender for alcohol fuels.

Agricultural Economist Harold Breimeyer has suggested that the conversion of a major portion of the U.S. farm output from

food to alcohol fuel could produce great changes in the American diet. The situation is complicated, however, since many factors must be considered. For example, an increased market demand in price for corn could result in the substitution of corn for land that is now producing other grain crops, most notably, sorghum. The greater water demand by corn may preclude any significant increase in corn acreage in Texas with the possible exception of east Texas. An increase in the price of corn may result in a shift in livestock feeds towards an increased use of pasturage. Increased production of range-fed beef with its lower fat content would be of benefit to our diet.

There is considerable potential for the utilization of various crop residues for alcohol production if the relative inefficiency of cellulose conversion to sugar can be improved. Thus, it may be possible to increase alcohol fuel production from farmlands without directly competing with food production. However, the removal of crop residue denies the soil a major source of organic input. If agriculture is to become a major source of renewable energy, then we need to develop practices that minimize the ecological impacts. For example, genetic breeding and agronomic practices for corn have emphasized protein production. It may well be possible to reduce both water demand and nitrogen fertilizer demand if the emphasis were on carbohydrate production for eventual use in energy production. Also, since grain mixtures can be utilized in fermentation vats, it may also be possible to develop methods for mixed crop planting. For example, with total carbohydrate yields as the

objective, it may be possible to develop polycultures of sorghum and corn with high yields.

PESTICIDE USE[30]

Texas uses between 150 million and 200 million pounds of pesticides annually. Excluding household and garden use, the major use in agriculture is for cotton and vegetables. Despite the knowledge that exposure to pesticides can cause serious illnesses and that farm workers have a life expectancy substantially below the average for the nation, there is very little systematic monitoring work on pesticide use in Texas. According to the Texas Pesticide Research and Education project,[31] approximately 5.8 million pounds of chemicals were used in 1978. About 25 percent of the pesticides used in Texas in 1977 required restricted registration by the Environmental Protection Agency. Pesticides are, of course, regulated at both the state and federal level. Federal law sets minimum standards, and the EPA registers the chemicals, but much authority still resides in the state.

The Texas Department of Agriculture (TDA) is responsible for registering pesticide use in Texas and for training and licensing pesticide applicators and dealers. It is also responsible for monitoring formulation, use, and the final disposal of pesticides. Despite this great work load, in 1981 TDA had only a staff of 23 people working on pesticide-related activities. The TDA does not keep records of the distribution or use of restricted-use pesticides, nor does it keep records of poisoning incidents. In 1980 the National Asociation of Farm Worker Organizations found the following in a Texas sample: Eighty

percent of workers had skin rashes, 40 percent had chronic headaches, 51 percent reported dizziness, and 23 percent reported blurred vision.

Pesticides reduce environmental quality and influence ecosystems by reducing species diversity. Food chains are modified, patterns of energy flow and nutrient cycling are altered, soil, water and air quality are reduced, as is the stability and resilience of ecosystems. It is estimated that as little as one percent of applied pesticides reach the target organisms. Most reach nontarget sectors of the agroecosystem and/or spread to surrounding ecosystems.[32] Crop ecosystems are particularly susceptible to pesticide stress since they often lack a variety of flora and fauna. Orchards, cotton, corn, soybean and vegetable systems are most vulnerable.[33]

U.S. crop losses without the use of pesticides have been estimated to increase from the current 33 percent to 42 percent. No serious food shortage would occur, but production of certain fruits and vegetables would be greatly reduced.[34]

It is possible to greatly reduce the amount of pesticide used in agriculture. By utilizing a variety of techniques that include cultural practices, monitoring pest population levels, introducing biological agents to control pests, and only selectively using pesticides, yields may be kept high while costs are reduced. This approach is known as IPM (integrated pest management) and has been the subject of much research at Texas A & M University. In cotton, IPM has resulted in a 30 percent increase in yields, while inputs have been reduced by 33 percent

and energy use has been cut in half. For the producer this has meant an increase in profits of two to ten times.

MAJOR CROPS

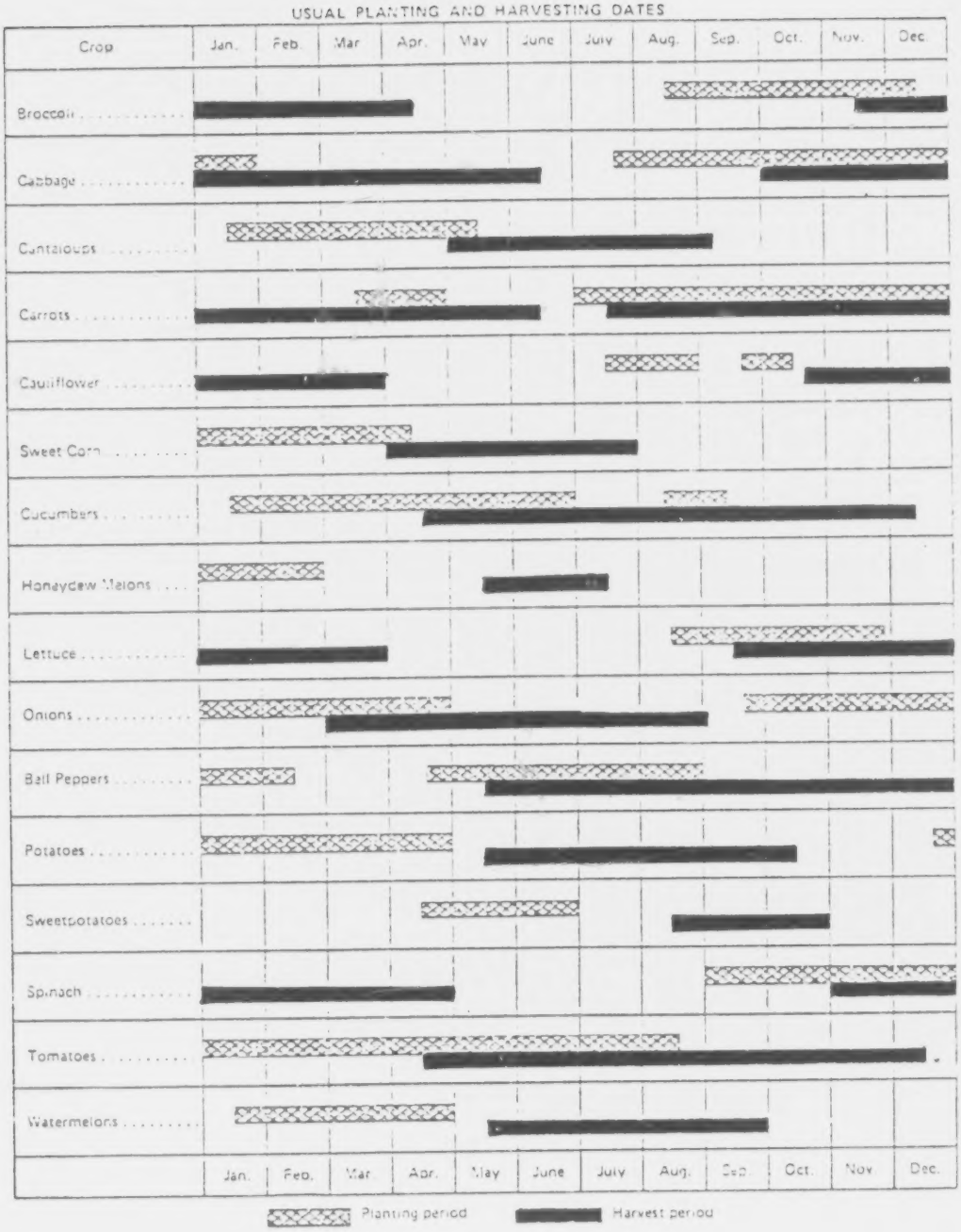
Vegetables

The history of vegetable production in Texas has been one of increasing regional specialization and decreasing crop diversity. In 1949 there were nineteen different vegetables reported on the basis of 100 or more acres per vegetable. By 1964 beets, broccoli, lettuce, romaine, and spinach were no longer reported. For most vegetables an average of thirteen counties reported production acreage below the 100 acre minimum basis for reporting. Only three vegetables -- cabbage, carrots and cucumbers -- reported an increase in the number of producing counties. Of the ten Texas counties with the highest vegetable acreage, Hidalgo County has 46 percent of the vegetable acreage. Within Hidalgo county, five crops, carrots, tomatoes, onions, cabbage, and cantalopes make up nearly two-thirds of the total vegetable acreage. Over all Texas counties, the period between 1949 and 1964 witnessed a 28 percent decrease in the variety of vegetables grown per county.

The fact that the ten Texas counties with the highest vegetable acreage are located in the southern third of the state is no accident. As shown elsewhere in this report, the climate in the southern third of the state is distinctly warmer throughout the year than in the rest of the state. Figure 5 shows the distribution of marketing seasons for the major vegetables produced in Texas.[35] This figure illustrates that

FIGURE 5.

USUAL PLANTING AND HARVESTING DATES



twelve vegetables have their major production periods during the winter months. Thus, the ten major vegetable producing counties also are commonly referred to as the winter garden of Texas.

In addition to mild winter temperatures for vegetable production, other production factors are also important. In contrast to the heavy clays of much of central Texas and the acid soils of east Texas, the soils of southern Texas are fertile and well drained. While the soils of the northern panhandle district are fertile, vegetable production is frequently limited by excessively cold winters, unpredictable spring temperatures, and a lack of water. Vegetable production is relatively labor intensive. Therefore, the availability of cheap farm labor from Mexico plays an important role in keeping production costs low.

In Figures 6 and 7, the distribution of all vegetables according to acreage classes is shown for the years 1945 and 1978. It was necessary to use two different acreage class scales for the different years since the upper range for vegetable acreage was much larger in 1978, although it was also much more regionalized. These figures show that in 1945, vegetable production was relatively evenly distributed between the northeast and southeast corners of the state. By 1978 the relative concentration had shifted strongly to the southern third of the state, the region known as the winter garden or the lower Rio Grande Valley.

Were it not for economic factors, vegetable production could be much more widespread in Texas than it is currently. However, an increase in commercial production of vegetables carries with it several environmental costs. As a class, vegetables receive

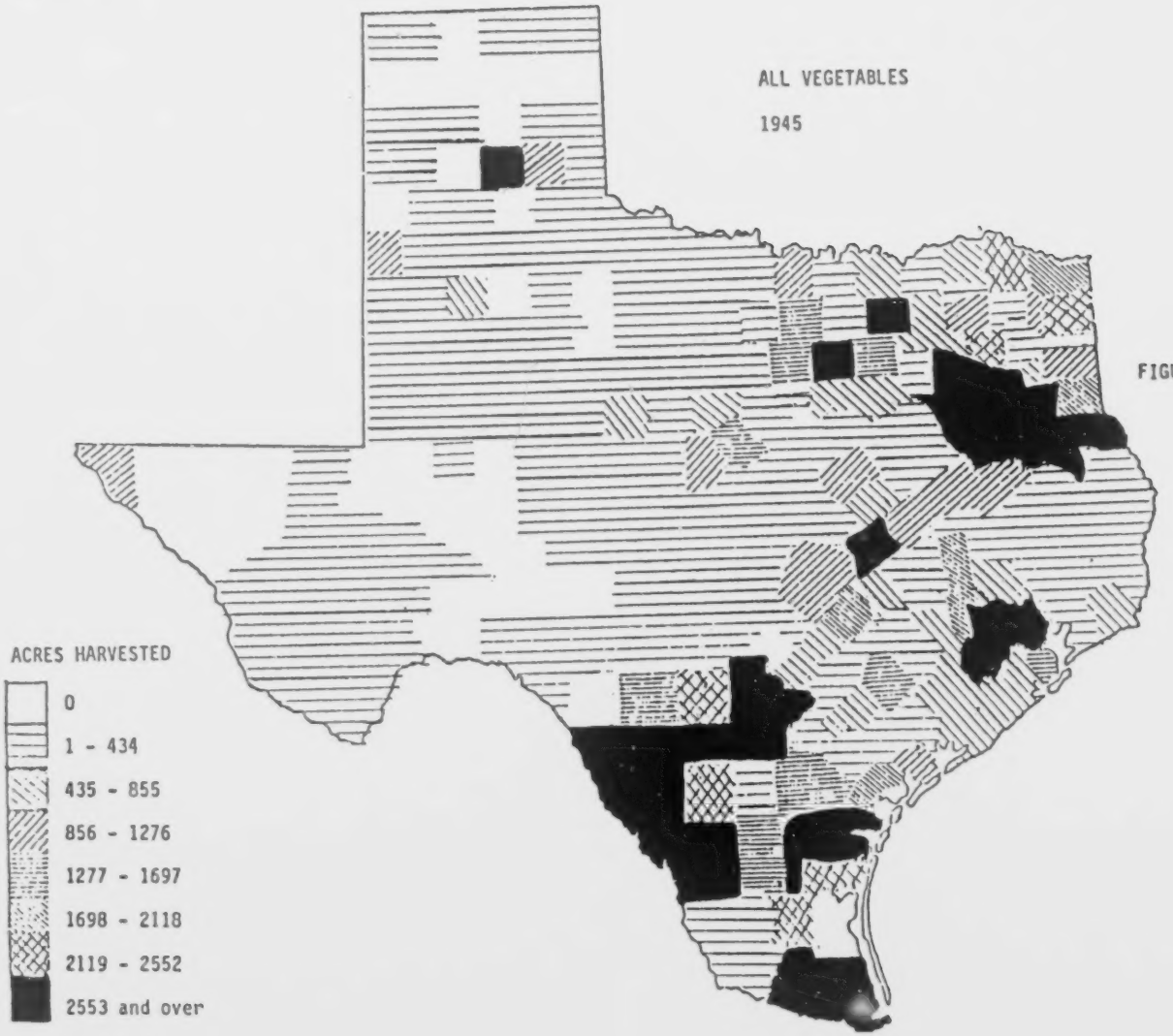

ALL VEGETABLES
1945
ACRES HARVESTED
0
1 - 434
435 - 855
856 - 1276
1277 - 1697
1698 - 2118
2119 - 2552
2553 and over

FIGURE 6.

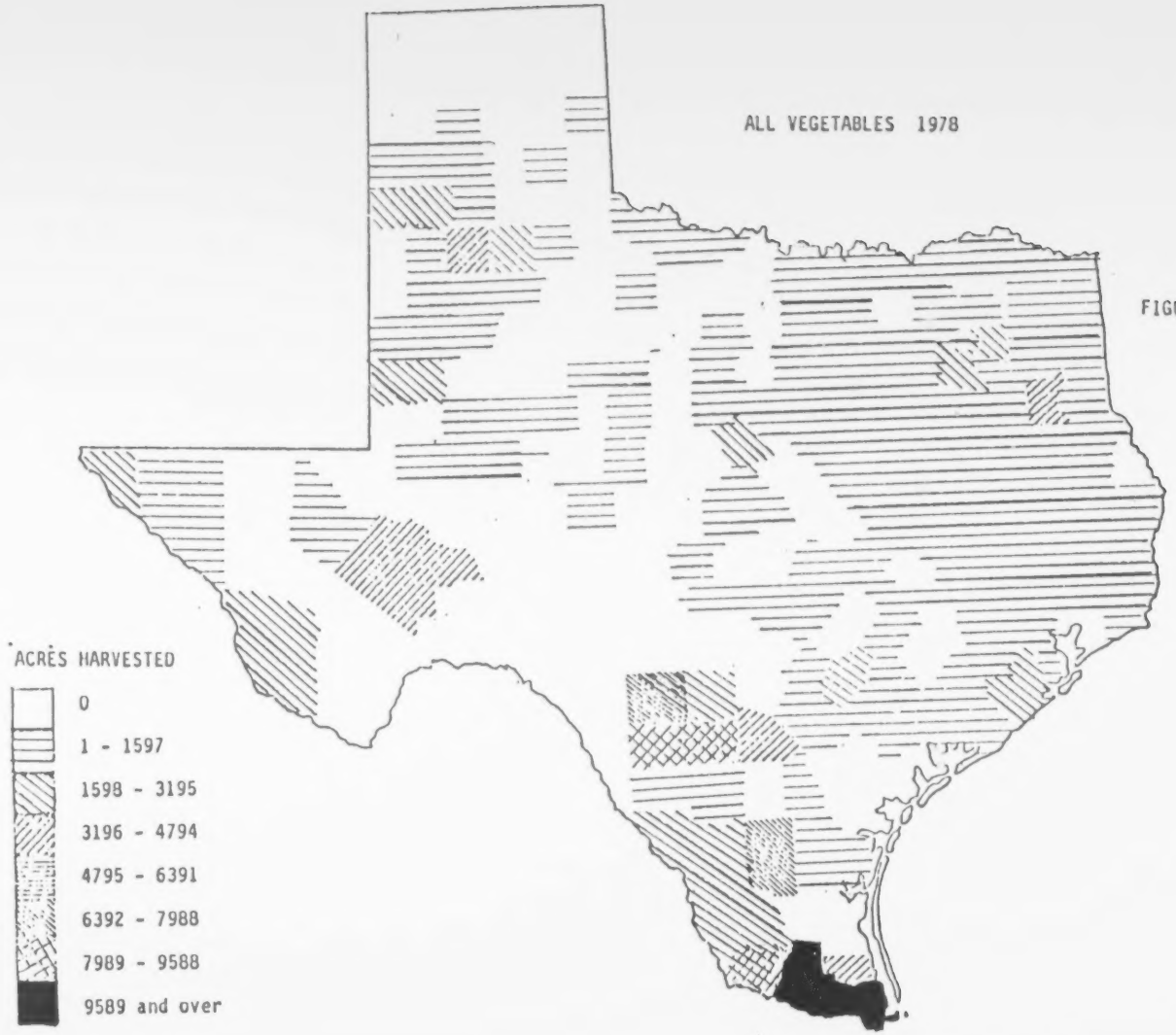

ALL VEGETABLES 1978
ACRES HARVESTED
0
1 - 1597
1598 - 3195
3196 - 4794
4795 - 6391
6392 - 7988
7989 - 9588
9589 and over

FIGURE 7.

more pesticide application than any other crop except cotton. Since vegetable production is still relatively labor intensive, the risk to farm workers of pesticide exposure is an important hazard. A second environmental cost common to row crops is that of soil erosion. Current production practices for vegetables call for relatively wide row spacing and no winter cover crops. A third environmental cost is the large demand that vegetables have for water. Given current commercial production practices, only the eastern-most third of the state can support vegetable production without irrigation. The combination of rising natural gas prices to fuel irrigation pumps coupled with rapidly dwindling supplies of aquifer water will not make commercial vegetable production feasible for most of the state. We wish to emphasize, however, that these limitations apply to commercial production given current practices.

While there are indeed limits to commercial vegetable production, Texans can make a significant contribution to their personal food supplies by growing some of their own vegetables. In 1983, 29 percent of all households in the West had vegetable gardens.[36] These gardens provide families with fresher, better tasting produce than is available in stores, and at a significant savings. The average vegetable garden requires an investment of about $30 and provides the gardener with a harvest worth $400. This means that in 1983, Texas' 1.5 million home gardens produced 844 million pounds of vegetables worth over $607 million.[37]

Principal Grain Crops

The principal grain crops for Texas are sorghum, corn, and

wheat. Since all three crops may be grown for silage, forage, or grain, it is difficult to discuss yields, production practices, or possible future developments. How any particular crop is used will depend on such external factors as the availability of hay, the price of livestock and the market demand for grain. The rising interest in the use of grains, especially corn and sorghum, for fuel alchohol production may stimulate more future grain production. In 1945 corn and sorghum harvested for grain had a complimentary distribution with corn grown largely in the prairie regions of central and east Texas, while sorghum was largely concentrated in the High Plains region of the panhandle.[38] By 1978, corn production had shifted to southeastern Texas and to the northern High Plains.[39] Sorghum followed a roughly similar pattern with an additional north to south band of commercial production extending through the Blackland Prairies region of central Texas. Over the past thirty years, sorghum has consistently been planted over more acreage than has been given to corn. A major reason why sorghum is more popular than corn throughout much of Texas has to do with its generally greater tolerance to drought conditions. Early summer droughts are common in Texas and frequently cause great yield losses in corn. Because of improvements in breeding, dry land yields of sorghum have doubled since the 1950's. Also, compared with corn, sorghum requires less nitrogen fertilizer in order to realize its yield potential. These factors plus the increasing demand for sorghum as livestock food have made sorghum the number one grain crop in Texas.

While Texas is the number one producer of grain sorghum in the country it is also a major producer of winter wheat. Texas ranks third in production of winter wheat for grain, producing over 180 million bushels. Winter wheat was originally grown primarily in the Blackland Prairie region where it was frequently part of the seasonal rotation cycle with cotton. As early as 1920, winter wheat production shifted to the High Plains of north Texas, and this region has remained the commercial center for wheat production ever since. Corn and sorghum grown for grain are produced as row crops and such fields are, of course, subject to erosion. Winter wheat builds soil organic material and provides good ground cover during the heavy spring rains. Winter wheat, therefore, makes an important contribution to soil conservation as a cover crop and soil builder.

Cotton

Texas is the number one producer of cotton, cottonseed, and cottonseed oil with a combined export value of 838 million dollars in 1981. This represents nearly one-third of the total value of agricultural exports from Texas. Cotton is also a very expensive crop to produce, requiring large inputs of machine time for land preparation, planting, harvesting, and large application of fertilizers and pesticides. The cost of these inputs has risen sharply over the past decade. For example, the pesticide toxaphene rose from $5.85 per five gallons in 1977 to more than $44.00 by 1981. The price of the herbicide 2,4-D rose from $9.19 per five gallons to $61.00 by 1981.[40] Also, over the same period, diesel fuel rose 64 percent and fertilizers rose approximately 30 percent. The price, however, that the farmers

received for cotton increased by only 3 percent. A combination of rapidly rising production costs and slowly rising cotton prices has contributed to large increases in farm real estate debts.

A major contributing factor to the high production costs for cotton has to do with protecting cotton from its many insect pests. In Texas, over fifteen species of insects are major pests on cotton. Among the more prominent are the boll weevil, boll worms, and various aphids. The chemical control programs for these insects have resulted in cotton receiving the largest pesticide load of any agricultural crop. However, in recent years, a large effort involving several southern states to develop an integrated pest management program that reduces pesticide application has been made.[41] In Texas, especially in the trans-Pecos area, a program developed by Texas A & M University has resulted in substantial decreases in pesticide use while maintaining high cotton yields.

Livestock

Texas is the leading producer of range-fed beef. It ranks number one in total population of cattle and calves and in the value of these animals. Texas also ranks high in the total number of fed cattle marketed, second only to Nebraska. Texas has a popular image as a land of vast cattle ranches. However, nearly three-quarters of all the cattle operations in the state have less than fifty head. Less than 3 percent have more than 500 head.

The market price for cattle has great fluctuations. The

price per 100 pounds for calves ranged from a low in 1977 of $34.70 to a high in 1979 of $88.30.[42] A major factor in these large price fluctuations has to do with cycles of over-supply and under-supply. When beef prices are high, farmers respond by increasing their herd size, and one to two years later the market is over-supplied with beef, thus prices drop. The farmers respond to the price drop by cutting back herd size and the cycle continues. Other factors are also important. For example, drought years require that more feed be purchased for cattle and the rising operation costs result in declining stocking rates. The number of grain-fed cattle in Texas is also substantial. Nearly four million head were marketed in 1981, representing a decline of about one-and-a-half million from the peak year of 1978. The decline has been largely attributed to the recent increases in energy and feed costs since the mid-1970's. Currently the large surplus of U.S. corn and the more recent sharp drops in energy costs are expected to stimulate an increase in feedlot production.

While there are short-term fluctuations in the production and price of beef, there are also longer term cycles lasting at least ten years. The last production peak was in the mid-1970's, and we are currently in the beginning of a new production cycle.

Cattle production in Texas tends to be concentrated in the upper High Plains and in the central portion of the state. The ten leading counties account for approximately twelve percent of cattle production. This is about four times what one would expect if cattle production were divided equally among the counties. The distribution of beef cows that have calved in the

previous year is heavily concentrated in the central and southern portion of the state. What this indicates is that the High Plains is largely a feeder and feedlot operation. Approximately 60 percent of the fed cattle marketings are in the High Plains region. The heavy concentration of feedlot operations in a region that depends heavily upon ground water has given rise to concern of possible contamination through seepage of ammonia and other waste products.

While not as economically significant as beef production, Texas still ranks among the top ten states in milk production. The state has made some important advances in dairy herd improvement over recent years. Average milk production between 1977 and 1981 increased nearly six hundred pounds annually, while at the same time annual feed consumption was reduced by 1,000 pounds. A major factor in the increase in milk production is due to increasing the proportion of purchased feed and decreasing the average days on pasture. The economic consequence, of course, has been an increase in feed cost for milk production from $4.65 in 1977 to $6.61 in 1981 per hundred-weight of milk.[43] There has recently been an increase in dairy activity in the El Paso region to service that rapidly growing region. However, since the region has inadequate water to support dairy pasture, the industry relies largely on alfalfa purchased from New Mexico. Since alfalfa is grown in New Mexico using intensive irrigation systems, the rise of the El Paso dairy industry may not be economical or sustainable once irrigation in New Mexico becomes unprofitable.

For most agricultural products the patterns of import and export at the state level are largely unknown and can only be crudely estimated. However, due to the need to keep health certificate records, we do have a good understanding of the shipment patterns for live animals. In 1981 Texas exported about 1.9 million head of cattle and calves and imported approximately 1.8 million head. This, of course, tells us nothing about patterns of import and export for meat carcasses or canned and processed meats. At the national level, the United States is a large net importer of beef. In 1981 nearly two billion pounds of beef were imported into the United States.

Billie DeWalt, an anthropologist, has commented recently on the environmental and social consequences of this import trade.[44] He reports that for Central America, at least, the results have not been good. In Honduras, the total production of beef increased 231 percent since the 1960's while per capita consumption declined more than any other country during the same period. Exports of beef from Central America have increased rapidly. DeWalt points out that while during the past twenty years production increased by 170 percent, the export portion increased by 468 percent, with the United States receiving approximately 90 percent of Central American exported beef.

Much of the beef production in Central America is controlled by multi-national corporations with the products ending up in processed foods and pet foods in the United States. Since malnutrition rates in Central America are high, the nutritional consequences of this meat export trade are obvious. Less obvious perhaps, is the impact that this export trade has on Central

American agriculture as a whole. Increased cattle production requires increased acreage in pasture. In general, this increase in pasturage has come from cutting down forest land and from displacing basic food production. Imported beef in the United States is therefore linked to increased land erosion, decreased forest areas and decreased croplands for basic foods in Central America.

RECOMMENDATIONS: PLANNING FOR REGENERATION

Developing a secure, sustainable, and affordable food supply is the major goal of The Cornucopia Project. To attain this goal will require a great deal of effort on many levels -- from consumer and farmer to industry and government. The Cornucopia Project has developed a set of recommendations for Texas that could help create a more vibrant state economy, a more secure and affordable supply of food, and an environment that is sustainable into the 21st century.

The major strategic themes running through all of the recommendations are outlined below. These four points are the most important and deserve the highest priority. They are followed by a series of more explicit recommendations aimed at the various participants in our food system -- namely, the consumer, who is the foundation of the entire food system and who has the most power to change it; the farmer, who produces our food; the food industry, which processes and distributes our food, and which has the power to improve our food system in relatively short order; the cities, which will be hit hardest by any food crisis; the state, which has the power to do many of the things necessary to make Texas' food supply secure; and the research community, which can improve the system we now have.

MAJOR STRATEGIC THEMES

I. Texas Should Grow More Food for In-State Consumption

Growing more food in-state will help the Texas economy by keeping more food dollars in local areas, by reducing the $19

million food transportation bill, and by creating jobs and increasing state revenues. Food will also be fresher and taste better, not having been subjected to early harvesting and long-distance transportation. Far less energy will be consumed in getting food from the field to the table.

II. Texas Should Encourage Local Markets

The benefits of buying locally as much food as possible are numerous and include lower transportation costs, less energy consumed in transportation, less waste due to long distance hauling, and potentially more nutritious produce since vitamin and mineral content decreases with time following harvest. Local farmers benefit as much as consumers because they have a market for their produce which will pay more than an interstate broker. U.S. Department of Agriculture studies of direct markets in Colorado showed that local farmers received 44 percent higher gross returns if they sold locally than if they marketed through wholesale channels. Consumers received an average 28 percent discount compared to supermarket prices. A study in New York City showed price savings ranging from 7 to 35 percent.

One quick and inexpensive way to augment Texas' existing marketing program would be to conduct and publish a survey of all food producers and large-volume food buyers -- such as grocery stores, hospitals, industry, and restaurants -- to determine what farmers would produce, given a market, and what institutions would purchase, in terms of commodity and quantity. Farmers would know what the market was and buyers would know where to obtain fresh, wholesome produce.

III. Texas Should Maintain Its Farm Resource Base

Soil is the foundation of one of Texas' largest industries. And so it is imperative that attention be given to the tons of soil being washed away irretrievably into our streams, rivers, and lakes. Once the soil is lost, there is little hope of producing food for anyone, let alone of attempting to make our state more self-reliant.

Preservation of Texas' farmland can no longer be a debatable issue. We need all our prime farmland. We can't afford uncontrolled, rampant development on our best lands.

Farmers are critical components of our food system. Efforts must continue to make their livelihood profitable, sustainable, and accessible. People who wish to farm must have the financial and technical support to do so. Farm support services must be maintained to provide essential materials and services to the farm community. Farm equipment dealers, seed and fertilizer salespeople, feed mills, and agricultural credit associations as well as the coooperative extension service supply some of the necessary inputs to the farm sector. The strength of Texas' farm resource base is dependent upon these component parts. Support services are no less important than the other elements.

IV. Texas Should Continue to Expand Consumer Education and Awareness

Informed consumers can actively participate in working towards sustainablity and regeneration in the food system. Consumer demand can effectively influence the Texas food industry more than any regulatory or legislative action. Individuals can also have a tremendous impact on local grocery stores and their

purchasing policies simply by asking for locally-grown, locally-processed foods. Increased consumer awareness and action may be the single most effective force in changing the direction of Texas' food system.

The following set of recommendations offers more detailed analyses of what consumers, farmers, the state and local governments, the food industry, and our research community can do to regenerate Texas' food system.

RECOMMENDATIONS TO CONSUMERS

1. Become more active in your food system. Increase your awareness of what foods are locally produced and which are transported in from other areas of the country. Know the nutritional quality of the food you consume. Share information with friends, neighbors, and supermarket and grocery store personnel.

2. Form a local Cornucopia Project of people who want to change their food system. Possible activities include home and community gardens, bartering, cooperative food buying, storing and preserving, food banks, and gleaning from harvested fields.

3. Purchase locally-grown fruits and vegetables in season, taking advantage of their peak nutritional value and decreased cost. You can also process these foods and store them for cold weather months to eliminate the higher prices of commercially processed and packaged food.

4. Support your local farmers by purchasing food directly from growers, thereby increasing their needed financial support while enjoying fresh, nutritious foods at reasonable prices. Start food co-ops and for additional savings, contract with farmers in the region to produce some of your food.

5. Start a home garden to produce more of your own fruits and vegetables. Community gardens provide a greater selection of produce when the harvest is shared with cooperating gardeners. They offer access to land for those (especially urban residents) who might otherwise be unable to garden.

6. Start a land trust which could purchase critical agricultural properties as they come on the market, resell them with deed restrictions to new farm owners, or transfer them to other appropriate trusts or to the city, county, or state at some future time. A land trust is a non-profit corporation which is able to own real property or interest in real property. It is one way to offer permanent protection to selective farming areas within local communities.

RECOMMENDATIONS TO FARMERS

I. Farmland Preservation

1. Take advantage of existing laws. Farmers should become better informed about specific state and local laws which can benefit them.

2. Learn about the diversity of technical assistance and services available to farmers through local conservancies and land trusts, which can show them the best options for the future use of their land, including areas which are not essential to farm production. This kind of planning service would help farmers realize certain economic benefits while still maintaining and preserving their farm operation.

3. Preserve farmland by markedly deceasing soil erosion. Your local soil conservation district will provide you with assistance in developing or updating a soil and water conservation management program, suggesting strategies to build the soil and reduce the need for increasingly costly fertilizer inputs.

4. Reduce soil losses through combinations of structural and management practices, such as conservation tillage, cropland terraces and diversions, contour farming, the use of crop residues, winter cover crops, and hedges.

5. Have soils tested accurately to determine the nutrient value of the soil and its fertilizer needs in order to prevent overuse of costly, energy-intensive fertilizers. Beware of inaccurate soil testing services.

II. Farm Inputs/Resources

1. Diversify production with selected combinations or rotations of crops or an interplay of crops with livestock. This practice would reduce fertilizer and weed control costs while providing the farmer with greater market stability.

2. Diversify production regarding not only types of crops but individual strains of a single crop so as to reduce the risk of farm pests blighting the entire crop.

3. Reduce energy use by investing in more fuel-efficient machinery, looking into solar dryers, letting crops dry naturally whenever possible, adding insulation where feasible, and taking advantage of natural lighting in farm buildings. Investigate possibilities for using alternative energy sources, whether this be the conversion of manure

into methane or the use of solar heat for crop drying and other on-farm energy requirements.

4. When dealing with different soil types in large fields, consider reducing field size for maximum ecosystem diversity. This would establish a healthier ecosystem.

5. Consider using management practices that will reduce the need for chemical fertilizers, pesticides, and other expensive inputs.

6. Develop on-farm fertilizer sources by growing nitrogen-fixing legumes and green manure crops.

7. Avoid routine spray schedules. Apply pesticides only when needed and target spraying to delay the onset of insect resistance, reduce undesirable residues, do minimal damage to beneficial insects, and decrease costs.

8. Consider alternatives to pesticide use and/or reduction. These could be: integrated pest management involving monitoring pest levels for proper timing of applications, no-tillage, crop rotations and interplanting, narrow rows or broadcast seeding to establish a canopy sooner than with wide row spacing,and biological control of pests to maintain the natural ecosystem.

III. Marketing/Economics

1. Organize marketing co-ops to provide restaurants, schools, and other institutions with locally-grown produce.

2. Work cooperatively with the consumer by selling directly to the public. This will ensure a higher price for the farmers' goods, and fresher produce for the consumer at a lower cost.

3. Locate marketing centers strategically for the assembly, grading, packing, and distribution of the output from many small producers thereby providing large buyers with the volumes and specifications they require.

4. Consider small-scale processing on the farm such as processing sausage, cured meats, pickles, preserves, cheeses, etc. Fresh produce can be washed, sorted and packaged for sale to restaurants and markets. Dried beans, nuts, and seeds as well as honey can be sold to local food stores and restaurants.

5. Investigate before planting what specific varieties of crops purchasers wish to buy by surveying bulk food purchasers in your area.

6. Sharpen marketing skills by examining price movements to forecast supply and demand. De-emphasize concentration on

farm production while allowing time to think, plan, read and analyze the current market so as to obtain a better price for agricultural products.

7. Begin to work towards changing grading and marketing standards that reflect the nutritious quality of the crop rather than its uniformity and appearance.

8. Encourage local newspapers, if a section is not already provided, to devote columns to farm problems and a listing of local/seasonal food availability.

RECOMMENDATIONS TO LOCAL GOVERNMENTS

1. Aid and encourage local food production and distribution by instituting a department to regulate and protect agricultural land use, encourage urban and rural food production, develop urban markets for local produce, initiate educational programs, and create plans to meet normal and emergency local food needs through local production and storage.

2. Identify the long- and short-term costs to a township before converting any prime farmland to development use.

3. Develop and encourage local food production by:

   a. Establishing city-run gardens in low income areas, and/or providing seeds, tools, and technical assistance on gardening to those receiving food stamps and other kinds of food assistance.

   b. Providing funds to establish gardens and/or greenhouses and subsidizing gardens in schools, prisons, hospitals, and nursing homes.

   c. Establishing farms on urban fringes to be worked by local farmers.

   d. Promoting contract growing whereby groups of urban families, co-ops, or the city itself arranges to purchase food directly from a local supplier.

   e. Developing loan funds for food self-reliance projects, such as greenhouses, food preservation and storage operations, and small businesses associated with urban agriculture.

   f. Establishing urban agricultural testing programs with the state Cooperative Extension Service to test crop varieties, analyze soil for nutrients and pollutants, test crops for pollutant residues, prepare demonstration sites for various types of urban agriculture and waste recycling, and offer technical assistance on farming as well as design and construction of community greenhouses, cold frames, rooftop gardens, etc.

   g. Encouraging local industries which produce low grade waste heat to make use of this energy by producing food in attached greenhouses.

   h. Requiring garden areas in new multiple unit housing projects.

i. Making certain that urban street tree programs preserve solar access for food production.

4. Develop and encourage local markets by:

   a. Establishing farmers' markets in the city, particularly in low-income neighborhoods, and facilitating authorizations for farmers to accept food stamps at the markets.

   b. Creating mobile farmers' markets and/or fish markets to visit housing projects, neighborhood centers, factories, and universities.

   c. Assisting in the formation of food cooperatives, co-op stores, and preservation/storage centers.

5. Develop and encourage local food processing and storage by sponsoring community food preserving facilities where residents use this service free or at a low cost and/or providing incentives to grocery stores to establish food preserving facilities for their shoppers.

6. Facilitate access to food by implementing a "food hotline" to provide referrals for emergency food, food stamps, and meals for elderly.

7. Create a greater understanding of the importance of agriculture to urban areas through educational programs. Offer seminars in urban agriculture, aquaculture, container and rooftop gardening, food preservation, storage, preparation, and nutrition.

8. Establish food banks in your area to store and distribute surplus food.

9. Have county institutions purchase their food supplies from local farmers.

10. Preserve the remaining farmland in the vicinity by creating agricutlural open-space preserves to retain prime farmland for agricultural use.

11. Set aside areas for recycling facilities.

12. Investigate the benefits of joint municipal planning. This process of joint planning could be particularly beneficial for those communities wanting to adopt some form of agricultural zoning and/or transfer of development rights ordinance.

13. Consider applying part of the monies from the real estate transfer tax to a local purchase of development rights program.

14. Investigate land-use techniques like clustering, performance controls, and transfer of developement rights which would give farmers greater options to develop either on the farm or in other areas within the community or region.

15. Establish an Agricultural Development Council similar to the one in Chester County, Pennsylvania. This council would focus on generating economic solutions to the problems of farmland loss in the counties. These local agricultural development councils would be comprised of people from the entire food system in the county and include farmers, processors, distributors, store managers, and farm service equipment dealers, as well as realtors and bankers. The council could develop local markets for local producers. It could survey local producers to see which ones would grow produce for local consumption and survey local stores, restaurants, and institutions to encourage them to purchase more locally grown foodstuffs. The council could also determine where local food is coming from and could promote more consumption of local foodstuffs. As suggested by Chester County, the council could become involved in "farm brokeraging" which would match new farmers with those who want to sell.

16. In addition to enforcing the soil erosion and sedimentation control measures, pass local ordinances similar to the one in Sterling, Wisconsin, which is successfully conserving all agriculture lands over one acre in size with a slope greater than 6 percent.

17. Undertake joint cooperative agreements, Memoranda of Understanding with your local conservation district whereby Township Supervisors enable the district to review subdivision plans for adequacy of erosion and sedimentation control and stormwater management. It would also give the conservation district permission to inspect earthmoving activities to insure implementation of erosion and sedimentation control practices.

18. Investigate the agricultural Land Evaluation and Site Assessment (LESA) system being developed by the Soil Conservation Service and the U.S. Department of Agriculture. The program will assist planners in identifying farmland that should be protected based on land capability, soil productivity, soil potentials, and "important farmland" rating.

RECOMMENDATIONS TO THE STATE

1. Promote agricultural production within Texas and in nearby states by:

   a. Offering incentives for farmers to diversify production, utilizing technical assistance from extension agents and low-interest state-guaranteed loans to make changes necessary for diversification.

   b. Mandating a study by our Department of Agriculture, investigating the potential for producing various crops needed in the state.

   c. Establishing demonstration experiments to test crop, animal, and fish varieties suitable to our soil and climate as well as developing low-input sustainable farming techniques.

   d. Providing tax incentives for small-scale food producers, such as not taxing the first $10,000 of income from food produced for local consumption.

   e. Issuing state tax credits for home and farm production, processing, and storing of food.

   f. Encouraging new farmers through loans and incentives to enter into certain types of farming operations, those which would maintain the optimal balance of farm types in the state. (See Research Recommendations #1)

   g. Initiating a program like New England's Small Farm Management Assistance Program to provide practical farm management skills to small-scale commercial farmers on a one-to-one basis.

   h. Organizing a farmer linkage program whereby experienced farmers bring prospective farmers into their operation, easing the transfer of land ownership over time. In this way the new farmer would be more successful in avoiding costly farming mistakes while gaining the tenured operator's knowledge of the farm.

   i. Establishing a statewide Agricultural Development Council which would seek to enhance the viability of farming throughout Texas in the same way that industrial development agencies seek to encourage industry to locate in-state. This kind of council would consist of representatives from all parts of the food industry.

2. Preserve remaining farmland in the state by:

   a. Publishing guidelines to help local governments protect agricultural land and enhance farming. These guidelines could include ways to prevent "leapfrog" or random development, which removes from production not only the land that has been developed, but which in the long run isolates adjacent farming areas and inhibits certain farming activities. The state could also delineate ways whereby municipalities could best protect farmland in urban fringe areas, and it could prepare guidelines for different kinds of farmland preservation strategies and techniques including agricultural zoning, transfer of development rights, purchase of development rights, community land trusts, performance zoning, and so forth. It could prepare procedures which would help local governments assess the different kinds of strategies that would be most appropriate and feasible for them, given the extent of farming in the area, development pressures, commitment of farming community to remain in agriculture, existing and potential land use, economic characteristics, natural features, and attitudes of local residents.

   b. Mapping all farmland that the state believes should be protected from development, identifying all Class I and II soils that are crucial to the agricultural capabilities of the state. The state of California has been engaged in mapping all of its farmland for the last few years in order to identify those areas that are important to the state for agricultural production.

   c. Instituting a farmland capital gains tax in ways which would discourage speculators from investing in farmland, and then re-selling it for development.

   d. Creating a committee to inventory and monitor all state-owned farmland and assess its productive capability while working to ensure that this land remains in farming.

   e. Encouraging municipalities to work together through joint municipal planning by working together to enact and adopt joint municipal comprehensive plans and joint municipal zoning ordinances. This would be one way to achieve agricultural zoning on a more regional basis, which could anticipate many of the current challenges to its constitutionality.

3. Stop or decrease the loss of our topsoil by:

   a. Enforcing existing anti-erosion laws by establishing new penalties for erosion damage. This would involve prohibiting all agricultural production activities which result in more than five tons of soil loss per

acre per year.

b. Enforcing the soil erosion and sediment control law that requires a conservation plan for all agricultural lands in excess of 25 acres.

c. Linking economic programs, such as loans, crop insurance, disaster relief, and state purchase of farm commodities, to the avoidance of excessive soil erosion.

d. Instituting and enforcing a "severance tax" on soil losses due to excessive erosion to finance subsidies, to encourage conservation practices, and to pay for downstream dredging of silt, damage to water treatment facilities, and other social costs.

e. Establishing rewards for soil enrichment, such as tax credits for on-farm soil and water conservation programs, including contour tillage, minimum tillage, and crop rotation. Using public subsidies, such as low-interest loans, preferential farm property tax formulas and valuations, and other tax incentives to encourage cover and permanent cropping, minimum tillage, ridge planting, proper rotation, longer rotations, biological nitrogen fixation, contour plowing, terracing, stripcropping, leaving harvest residues on soil surfaces, reducing soil compaction and salinity, intercropping, and regional organic waste recycling.

f. Developing incentives for encouraging the use of rental arrangements which include provisions for sharing erosion control and soil enrichment costs with the landowner.

g. Developing public awareness programs to promote understanding of the need to support sound soil conservation practices.

4. Expand local markets by:

a. Establishing more farmers' markets and organizing wholesale farmers' markets to supply retailers, consumer co-ops, and other volume purchasers.

b. Increasing promotional efforts for direct purchase of food from farmers by supermarkets, restaurants, schools, hospitals, and other institutions.

c. Encouraging existing processing plants to purchase locally-grown products.

d. Developing linkages between large-volume food buyers and Texas producers.

e. Giving preference to in-state producers in bidding for the sale of foods by permitting state insitutions to purchase foodstuffs directly from local farmers and in-state producers at prices at or in excess of the lowest submitted bid according to a percentage to be determined by the state.

f. Providing assistance to small growers through a statewide markets clearinghouse.

g. Assessing the viability of implementing in Texas marketing alternatives to determine price and maintain market access for individual farmers through electronic commodity markets, vertical coordination through forward contracting, forward deliverable contract markets, and mandatory public reporting of market information. Other options include exclusive agency bargaining, vertical integration through ownership, joint ventures between agricultural cooperatives and agribusiness-marketing firms, marketing orders, and marketing boards.

5. Strengthen in-state food-processing capabilities by:

a. Providing incentives for existing food companies to develop more energy-efficient processing and packaging techniques, along with incentives to attract new food processors who wish to reduce transportation costs by locating near a major distribution center.

b. Helping to establish community food processing and storage facilities for the use of families and small commercial food producers. In this way, economies in equipment and energy consumption can be realized.

6. Effect a transition from depletable to renewable energy sources by conducting regional inventories of all renewable energy sources and providing incentives, such as tax credits or low-interest loans for investments made in agricultural energy conservation and on-site development of renewable energy sources, or tax exemptions for income received from the production of renewable energy.

7. Recycle organic wastes to utilize their full potential by:

a. Preparing a state-wide inventory of the types and amounts of organic wastes available now and in the future and assess the ability of these wastes to improve soil fertility and tilth and their potential energy use.

b. Developing incentives for using local organic wastes for fertilizer and incentives to industry to separate toxic substances from their wastes so that they might

be more safely used on cropland.

8. Enact a bill which requires returnable bottles and the recycling of metal cans. This would reduce materials consumption in the food system.

9. Protect the natural environment by enforcing existing environmental protection laws, developing programs for safer handling of toxic pesticides and stronger enforcement of laws against pesticide misuse, and developing stricter standards for pesticide residues in foods. Collect data on pesticide use in Texas.

10. Develop long-range food system plans by:

    a. Revising and improving the methods by which crops and livestock production data are gathered so that the future direction of the state's agriculture situation is determined based on accurate, reliable information.

    b. Creating an overall state food policy which will increase regional self-reliance and economic viability while decreasing the vulnerability of the state's food supply.

    c. Planning for an emergency food supply disruption by strengthening our grain storage facilities capacity.

    d. Conducting an annual study of the condition of the state food system to find out the amount of food currently being imported and exported, soil erosion losses, amount of land lost to development, and other food system issues while stating what Texas can do to increase its self-reliance.

11. Instill a greater understanding of agriculture's importance by:

    a. Increasing awareness of seasonal, locally-grown produce, and its nutritional and economic benefits.

    b. Initiating educational programs on farmland preservation, farm energy conservation, reduced pesticide and fertilizer use, recycling of organic wastes, and energy expenditures in different methods of farming and home food production and preparation.

    c. Promoting nutrition education campaigns illustrating the relationships between diet and health and the benefits of fresh, locally-grown, and minimally processed foods, as well as bulk purchasing of food.

    d. Communicating goals and the condition of our food supply as revealed in the state's annual study.

RECOMMENDATIONS TO THE FOOD INDUSTRY

1. Encourage sustainable farming methods by using the food industry's influence on farm production techniques to decrease the use of dangerous pesticides and increase the use of soil conservation measures. De-emphasize produce appearance while concentrating on freshness and nutritional quality.

2. Minimize energy and material use by using less processing (and/or more efficient methods), simpler packaging, and rail networks more often in transporting commodities.

3. Move toward regionalizing food purchasing, processing, and distribution, thereby decreasing transport costs and strengthening the local economy with increased use of local labor.

4. Promote the consumption of fresh, locally-produced food in season, enhancing consumer nutrition and building a stronger local economy.

5. Provide nutrition education, hints for food preparation, and techniques on preserving fruits and vegetables.

6. Focus on food in a holistic way, recognizing that diet is an essential component of a healthy life and is influential in preventing as well as treating illness.

7. Grocery stores should purchase and label locally grown produce. Point-of-purchase literature could be made available to consumers to make them aware of where food originates and the issues involved with this.

RECOMMENDATIONS TO THE AGRICULTURAL RESEARCH COMMUNITY

1. Determine the optimal mix of farm types in Texas to obtain sustainable yields of both crops and livestock to meet the state's consumption needs and to provide a sufficient level of exports. Determine the production needed to support processing plants for various commodities. If the commodity is produced in quantities sufficient to make a processing plant economically competitive, this would be an incentive for establishing those businesses in state.

2. Assess relationships between biofuels development (including forest resources) and long term soil productivity to provide guidelines for future programs.

3. Investigate how to improve the capability of using forage and Texas crop wastes.

4. Work to develop plants which resist pests.

5. Investigate Texas' soil erosion problems, looking at crop residues, run-off, tillage practices, rotation systems, terraces and equipment.

6. Investigate perennial agriculture systems (permaculture) appropriate to Texas to eliminate annual soil disturbance and decrease energy, fertilizer, pesticide, and herbicide usage.

7. Determine the long-term effects of recommended applications of chemical fertilizers, pesticides, and herbicides on the productivity of selected Texas soils.

8. Update the Stanford Research Institute inventory of the organic wastes in Texas which are available to improve soil fertility and tilth.

9. Investigate methods to utilize Texas' municipal wastes in agriculture.

10. Expand research on biological nitrogen fixation.

11. Develop crop varieties adaptable to low-input farming systems in Texas.

12. Explore the potential of small-scale aquaculture in Texas to provide high-quality protein using cost-efficient and ecologically sound methods.

13. Set up plots to study the transition phase of switching from conventional to regenerative farming systems.

14. Examine methods for producing food in cities, e.g. rooftop food production systems. Seek ways to make urban food distribution and marketing systems more accessible to local and regional food producers.

NOTES

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3. See Appendix 1, Texas Food Imports Chart.

4. According to Texas Food Imports Chart, 31 percent of the food consumed in Texas is imported.

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11. U.S. Department of Commerce, Bureau of the Census, 1978 Census of Agriculture Vol. 1, part 51, (Washington, D.C.: GPO, 1981), p. 472.

12. Ibid.

13. Ibid.

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15. The Decline of Black Farming in America, A Report of the United States Commission on Civil Rights, February, 1982.

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22. An overview of Texas Water Resource Problems and Water Resource Issues, Texas Department of Water Resources, Austin, Texas, 1982.

23. Analytical Studies of the Ogallala Aquifer, Texas Department of Water Resources, various county reports.

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26. Given irrigation use in north plains at 1.63×10^6 Ac. ft./yr., what is the enrgy cost to deliver 50 percent from east Texas?

    For an eight month season, this is equivalent to delivering 7.49×10^5 gallons per minute for 8 months. In order to raise that water to an average altitude of 3,000 feet, a power output of 5.67×10^5 HP is required. The cost over 8 months at $0.05 Kw per hr. is $118,022,184.00. This does not include any losses due to friction. Since the cash receipts from all crops in the northern High Plains in 1981 was $933,671,000., the operating costs for transferring 50 percent of the region's irrigation needs would exceed 12 percent of the total market sales. What profit margin would remain for the farmer?

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APPENDIX I:

TEXAS FOOD SYSTEM ORGANIZATIONS

There are many organizations which directly or indirectly are working towards developing a sustainable food system in Texas. Readers are encouraged to learn about the services of the different groups and where appropriate, to join with them. Changing our food system will occur much faster as more people participate.

American Lung Association
San Jacinto Area
2901 West Dallas
Houston, Texas 77019

Austin Community Gardens
302 East 41st Street
Austin, Texas 78751

Bread for the World
San Antonio, Texas
(512) 494-1042

Central Texas Lignite Watch
Box 728
Bastrop, Texas 78602

Centro Cultural Aztlan
San Antonio, Texas
(512) 733-7928

Citizens' Environmental Coalition
1413 Westheimer
Houston, Texas 77006

Communities Organized for
Public Service (C.O.P.S.)
San Antonio, Texas
(512) 222-2367

Continental Shelf Associates
17625 El Camino Real
Suite 200
Houston, Texas 77058

Dallas County Audubon Society
c/o Mr. Jack Harman
7426 East N.W. Highway
Dallas, Texas 75231

East Texas Quality of Life
Rt. 6, Box 36
Huntsville, Texas 7733340

Environmental Coalition of North
Central Texas
9440 Brentgate
Dallas, Texas 75238

For The People, Inc.
P.O. Box 191468
Dallas, Texas 75219

Greenhill Environmental Center
7575 Wheatland Road
Dallas, Texas 75249

Gulf Coast Fisherman's E.D.F.
c/o Sharron Steward
102 Carnation
Lake Jackson, Texas 77566

Gulf Coast Waste Disposal Authority
910 Bay Area Blvd.
Houston, Texas 77058

Habitat for Humanity
San Antonio, Texas
(512) 822-9900

Houston Sportsmen's Club
P.O. Box 12977
Houston, Texas 77017

Houston Toxic Substances Task Force
1413 Westheimer
Houston, Texas 77006

Institute of Environmental Studies
Baylor University -- CSB 402
Waco, Texas 76798

Panhandle Environmental Awareness
Center
1008 S. Madison
Amarillo, Texas 79101

Pax Christi
San Antonio, Texas
(512) 732-2136

Peacemaking Fellowship
San Antonio, Texas
(512) 732-9927

People for Peace
San Antonio, Texas
(512) 822-3089

Physicians for Social
Responsibility
San Antonio, Texas
(512) 735-8044

Pilko and Associates, Inc.
9800 N.W. Freeway #204
Houston, Texas 77092

PISCES
P.O. Box 13481
Austin, Texas 787'1

Proyecto Hospitalidad
San Antonio, Texas
(512) 736-9306

Residents Organized for Better and
Beautiful Environmental
Development (ROBBED)
San Antonio, Texas
(512) 226-3973

San Antonio Forum on Energy
San Antonio, Texas
(512) 653-0543

Sierra Club
600 W. 28th Street
P.O. Box 1931
Austin, Texas 78767-1931

Sierra Club
San Antonio, Texas
(512) 271-7169

Texas Center for Rural Studies
P.O. Box 2616
Austin, Texas 78768

Texas Farmers Union
5400 Bosque Blvd.
Waco, Texas 76798

Texas Farmworkers Union
P.O. Box 565
Hidalgo, Texas 78557

Texas Nature Conservancy
503-B East 6th Street
Austin, Texas 78701

Texas Pesticide Abuse
Coalition
P.O. Box 3934
Corpus Christi, Texas 78404

Texas Rural Legal Aid
259 South Texas Street
Weslaco, Texas 78596

Travis County Farmers Market
1708 E. 38th Street
Austin, Texas 78722

United Farmworkers
P.O. Box 1493
San Juan, Texas 78589

APPENDIX II

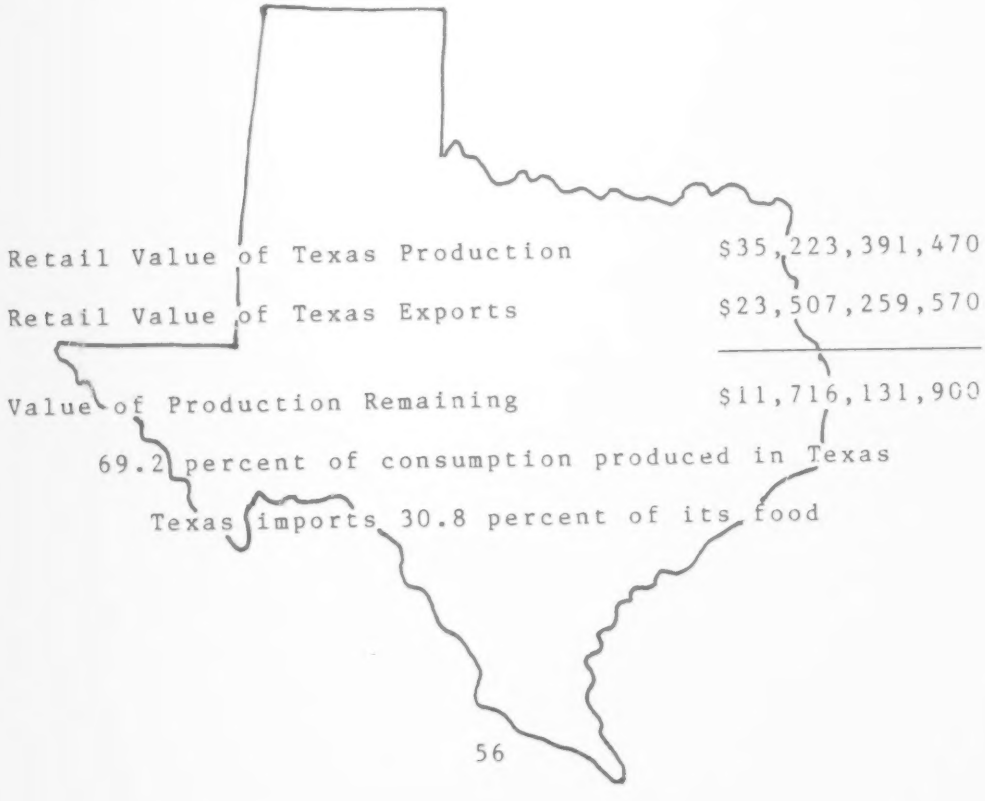
TEXAS FOOD CHART

Texas is one of the United States' most important agricultural producers. The state ranks among the top ten producing states for over twenty agricultural commodities. Texas sends its agricultural products all over the country and around the world.

Despite this productivity, 30.8 percent of the food Texans consume is imported from other states and countries. These food imports mean that Texans depend on others for almost a third of their food. Importing food means exporting food dollars, thus depriving the state of important economic activity.

The future of Texas' agriculture is threatened by increasing costs of production for farmers and the depletion of some crucial resource bases. The state needs to manage carefully its agricultural land and water resources, and to plan its agricultural system accordingly.

Consumers can make Texas agriculture a success story of regional production for regional consumption. Farmers' markets, roadside stands and pick-your-own operations provide fresher food at lower prices. By recognizing the state's food and agriculture system as a pricless resource, Texans can work together to develop a sustainable food system.


Retail Value of Texas Production $35,223,391,470
Retail Value of Texas Exports $23,507,259,570
Value of Production Remaining $11,716,131,900
69.2 percent of consumption produced in Texas
Texas imports 30.8 percent of its food

FOOD IMPORTS CHART

COMMODITY	RETAIL WT. OF PRODUCTION(a) (1,000 LBS.)	RETAIL VALUE OF PRODUCTION ($1,000)	RETAIL WT. OF CONSUMPTION(b) (1,000 LBS.)	RETAIL VALUE OF CONSUMPTION ($1,000)	% OF IMPORTS	VALUE OF IMPORTS ($1,000)	% OF EXPORTS	VALUE OF EXPORTS ($1,000)	ACREAGE*
MEATS							78.68	10,564,690.53	2,579,217.00
Beef	5,347,950.00	13,426,625.00	1,139,935.20	2,861,934.47			80.62	252,601.17	6,283.00
Lamb and mutton	106,650.00	313,336.44	20,672.40	60,735.27					730,419.00
Pork(c)	264,693.00	495,743.52	959,790.00	1,797,590.69	72.42	1,301,847.17			
POULTRY									261,294.00
Chicken	662,013.24	703,281.89	496,137.60	810,987.58	13.28	107,705.69			206,966.00
Eggs	421,806.67	343,772.44	496,402.20	404,352.19	14.98	60,579.75			87,877.00
Turkeys	117,070.10	109,928.82	157,996.20	148,358.43	25.90	38,429.61			
FISH							30.54	113,433.68	NA
Finfish(d)	197,545.05	371,384.69	138,800.40	262,160.55	4.65				NA
Shellfish	46,459.80	87,344.42	48,727.80	91,608.26	4.65	4,263.84			
									698,933.00
DAIRY PRODUCTS(e)									
Butter	insig.		63,493.80	135,495.77	99.00	134,140.81			
Cheese	insig.		268,741.20	559,292.88	99.00	593,299.95			
Cottage cheese(f)	43,807.00	37,891.18	64,970.40	56,196.62	32.57	18,305.44			
Fluid milk and cream	3,618,000.00	4,428,432.00	3,294,294.60	4,032,216.59			8.95	396,215.41	
Condensed & Evaporated milk	insig.		110,745.00	57,719.19	99.00	57,141.99			
Dry milk products	insig.		91,549.20	150,454.48	99.00	148,949.94			
Ice cream and ice milk(g)	532,138.50	1,146,758.47	357,337.00	770,061.24			32.85	376,697.23	
VEGETABLES, FRESH									NA
Artichokes	NC		7,383.00	4,073.90					2,028.00
Asparagus	NC		4,429.80	7,568.14					1,293.00
Broccoli	43,424.00	42,555.52	28,055.40	27,552.69			h		4,608.00
Cabbage	408,177.00	98,778.83	112,221.60	27,157.63			h		5,756.00
Carrots	266,750.00	88,027.50	93,025.80	30,698.51			h		3,482.00
Cauliflower	6,624.00	7,102.18	25,702.20	26,914.31	73.61	19,811.62			2,353.00
Celery	NC		106,315.20	36,784.61					6,187.00
Cucumbers	68,540.00	30,911.54	60,540.60	27,303.81			11.67	3,607.38	438.00
Eggplant	NC		7,383.00	3,924.35					642.00
Garlic	NC		8,859.60	22,137.93					4,907.00
Green peppers	72,776.00	56,838.06	47,251.20	36,903.19					

COMMODITY	RETAIL WT. OF PRODUCTION(a) (1,000 LBS.)	RETAIL VALUE OF PRODUCTION ($1,000)	RETAIL WT. OF CONSUMPTION(b) (1,000 LBS.)	RETAIL VALUE OF CONSUMPTION ($1,000)	% OF IMPORTS	VALUE OF IMPORTS ($1,000)	% OF EXPORTS	VALUE OF EXPORTS ($1,000)	ACREAGE*
Lettuce	76,074.00	36,211.22	351,430.80	167,281.06	78.35	131,064.71			43,490.00
Mushrooms	insig.		13,141.74	24,036.28	99.00	23,795.17			NA
Onions	393,672.00	103,142.06	135,847.20	35,591.97			65.49	67,547.74	8,334.00
Potatoes	228,576.00	43,886.59	695,478.60	133,531.89	67.13	89,639.96			38,585.00
Snap beans	NC		19,195.80	15,395.26					6,006.00
Spinach	41,565.00	15,895.85	11,812.80	4,517.61			71.58	11,378.25	1,456.00
Sweet corn	13,524.00	5,937.03	95,979.00	42,134.78	85.90	36,193.78			14,904.00
Sweet potatoes	66,690.00	33,942.49	47,251.20	240,048.94			h		5,526.00
Tomatoes	21,675.00	13,621.89	166,855.80	104,862.33	87.00	91,230.23			32,341.00
PROCESSED VEGETABLES(i)									
Asparagus	NC		5,315.76	10,584.50					2,961.00
Beans, lima	NC		11,812.80	6,672.28					4,018.00
Beans, snap	insig.		94,797.84	36,717.96					13,640.00
Beets	insig.		17,719.20	6,385.73					799.00
Broccoli	8,419.53	9,514.07	22,444.32	25,362.08	62.49	15,848.01			1,266.00
Brussells sprouts	NC		4,282.14	4,167.54					5,071.00
Carrots	98,461.55	59,076.93	7,443.04	4,465.82			92.54	54,611.11	2,150.00
Cauliflower	NC		8,268.96	7,690.13					1,509.00
Onions	211,051.76	107,636.40	10,336.20	5,230.12			95.14	102,406.28	775.00
Peas	NC		67,185.30	33,855.33					18,317.00
Pickles (j)	63,810.80	53,939.69	109,268.40	92,365.30	41.60	38,425.61			7,644.00
Potatoes (k)	NC		961,266.60	482,906.44					80,483.00
Sauerkraut	96.31	49.12	10,336.20	5,230.28	99.06	5,181.16			734.00
Spinach	insig.		18,457.50	9,302.58					8,994.00
Sweet corn	insig.		105,872.22	54,524.19					43,374.00
Sweet potatoes	16,418.84	8,701.99	16,242.60	8,657.31			0.51	44.68	1,710.00
Tomatoes	4,102.28	1,517.79	358,953.80	132,808.38	98.86	131,290.59			91,841.00
FRESH FRUITS (l)									
Apples (m)	608.56	352.36	295,320.00	170,992.10	99.79	170,639.74			63,743.00
Apricots	44.42	52.86	1,476.60	1,757.15	96.99	3,704.29			514.00
Avocados	773.96	557.85	26,578.80	19,157.18	97.09	18,599.33			NA
Cantalope (n)	242,788.00	106,826.72	116,651.40	51,326.62			51.95	55,500.00	9,579.00
Cherries	3.59	3.19	7,383.00	6,563.49	99.51	6,531.59			7,820.00

COMMODITY	RETAIL WT. OF PRODUCTION(a) (1,000 LBS.)	RETAIL VALUE OF PRODUCTION ($1,000)	RETAIL WT. OF CONSUMPTION(b) (1,000 LBS.)	RETAIL VALUE OF CONSUMPTION ($1,000)	% OF IMPORTS	VALUE OF IMPORTS ($1,000)	% OF EXPORTS	VALUE OF EXPORTS ($1,000)	ACREAGE©
Citrus									
Grapefruit (o)	561,048.00	164,387.06	98,932.20	28,987.13			82.37	135,399.93	6,250.00
Lemons	165.70	115.00	29,532.00	20,495.96	99.43	20,380.96			1,264.00
Oranges	273,734.00	138,509.40	199,341.00	100,866.55			27.00	37,642.86	18,735.00
Tangelos	1,195.34	239.07	11,812.80	2,362.56	89.88	2,123.49			355.00
Tangerines & Mandarins	560.02	162.41	17,719.20	5,138.57	96.84	4,976.16			726.00
Cranberries	NA		1,476.00	1,254.60					NA
Grapes	1,028.99	1,478.66	47,251.20	53,724.61	97.25	52,245.95			49,170.00
Nectarines	197.93	230.79	22,149.00	25,825.73	99.10	25,594.94			13,464.00
Peaches	27,748.80	18,036.72	78,259.80	50,947.13	64.60	32,910.40			18,567.00
Pears	1,362.99	658.32	39,868.20	19,256.34	96.58	18,598.02			10,846.00
Plums and prunes	377.32	439.96	25,102.20	29,269.17	98.50	28,829.21			5,916.00
Strawberries	174.96	142.24	31,008.60	25,210.00	99.44	25,067.76			12,520.00
Watermelon	416,610.00	135,398.25	163,902.60	53,268.35			60.66	82,129.90	17,268.00
PROCESSED FRUITS									
Processed grapefruit(p)	164,000.00	50,840.02	20,851.25	6,463.89			87.28	44,373.17	2,589.00
Processed oranges(q)	125,800.00	46,546.00	292,389.75	108,184.21	57.00	61,638.21			26,656.00
Dried fruits(r)	NC		35,438.40	114,309.70					8,518.00
Frozen non-citrus fruits	NC		43,559.70	60,912.21					s
Canned non-citrus fruits	NC		218,536.80	178,866.74					s
Canned and Frozen non-citrus juices	NC		171,137.94	162,951.84					s
FATS AND OILS									
Lard	19,564.00	9,254.39	36,915.00	17,461.90					t
Margarine	NC		165,379.20	126,680.92					s
Shortening	NC		273,171.00	201,600.20					s
Oils	NC		347,001.00	322,652.14					s
GRAINS FOR HUMAN CONSUMPTION(u)									
Barley	60,883.00	91,730.39	24,452.50	36,841.60			59.84	54,891.47	12,410.00
Corn	5,574,336.00	2,244,356.62	296,146.90	119,235.58			94.69	2,125,181.28	57,974.00
Oats	349,377.00	226,644.24	45,774.60	29,694.43			86.90	196,953.84	53,717.00
Wheat	8,032,920.00	1,728,235.42	1,762,026.78	379,089.68			78.06	1,349,060.57	1,447,[illegible]1.00
Rye	21,280.00	7,670.15	10,336.20	3,725.17			51.43	3,944.76	12,143.00

COMMODITY	RETAIL WT. OF PRODUCTION(a) (1,000 LBS.)	RETAIL VALUE OF PRODUCTION ($1,000)	RETAIL WT. OF CONSUMPTION(b) (1,000 LBS.)	RETAIL VALUE OF CONSUMPTION ($1,000)	% OF IMPORTS	VALUE OF IMPORTS ($1,000)	% OF EXPORTS	VALUE OF EXPORTS ($1,000)	ACREAGE*
MISCELLANEOUS(v)									
Honey	6,930.00	9,790.29	17,719.20	25,031.91	60.89	15,241.93			NA
Sugar beets	132,038.75	49,646.57	378,009.60	142,131.61	65.07	92,485.04			72,203.00
Sugar cane	226,071.89	85,003.03	798,840.60	300,364.07	71.70	215,361.04			132,105.00
Sunflowers	33,100.00		NC						NC
Rice	1,811,103.00	1,622,742.30	162,426.00	145,532.07			91.03	1,477,182.32	51,976.00
Dried field peas	10,400.00	6,653.99	5,906.40	3,778.91	43.20	2,875.08			7,383.00
Dried edible beans	NC		60,540.60	22,528.27					NC
Almonds	0.09	0.07	7,530.66	14,232.95	99.99	14,232.88			NC
Pecans	22,920.00	64,634.40	5,611.08	15,823.25			75.52	48,811.15	NC
Walnuts	0.83	2.48	23,841.18	23,841.83	99.98	23,838.70			NC
Peanuts	2,993,953.02	6,137,603.69	90,072.60	184,648.83			96.99	5,952,954.86	167,574.00
TOTALS	34,556,613.53	35,223,391.47	18,335,568.22	16,895,920.26		3,881,019.75		23,507,259.57	7,327,687.00

NOTES TEXAS FOOD IMPORTS CHART

a. Unless otherwise noted, production data is from: 1982 Texas Livestock, Dairy and Poultry Statistics, 1978-82 Yield and Price Statistics for Texas Agricultural Products, 1982 Texas Fruit and Pecan Statistics 1983, Texas Small Grains Statistics, 1982 Texas Vegetable Statistics;

b. Consumption data is from Food Consumption, Prices and Expenditures (Washington, D.C.: GPO, 1982).

c. Hog feeding requirements from Keith Haydon, Department of Animal Sciences, Texas Agricultural and Mechanical University.

d. Fish landing data from National Marine Fisheries Service, NOAA, Washington, D.C.

e. Acreage requirement is for total fluid milk required for all dairy products.

f. Includes curd, creamed and low-fat.

g. Production includes ice cream and ice milk mixes.

h. Excess fresh production is credited to processed production.

i. Processed tomato statistics given on canned basis.

j. Production statistics for pickling cucumbers from Vegetables, 1981 Annual Summary (Washington, D.C.: GPO, 1981).

k. Processed potato statistics given on canned basis.

l. Production statistics for the following fruits are from 1978 Census of Agriculture: apples, appricots, avocados, cherries, grapes, nectarines, pears, plums and prunes, and strawberries.

m. Acreage requirements based on New Mexico acreage requirements.

n. Includes honeydew melons.

o. Grapefruit and orange production is for 1981-82 crop year.

p. Processed grapefruit production given in terms of juice.

q. Processed oranges production given in terms of juice.

r. Includes apples, apricots, dates, figs, peaches, pears, prunes, raisins and currents.

s. Insufficient data to estimate acreage.

t. Lard is a by-product of pork production.

u. Grains given in terms of pearled barley, cornmeal, oatmeal, white flour and rye flour.

v. Sugar beets and sugar cane given in terms of refined sugar; rice given on milled basis; nuts given on shelled basis.

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THE CORNUCOPIA PROJECT

The Vermont Food System: TOWARD A TRADITIONAL SELF RELIANCE

A Study of the Food System of Vermont

BY

Richard Tarlov

AND

The Cornucopia Project of Rodale Press

The Cornucopia Project • 33 E. Minor Street • Emmaus, Pennsylvania 18049 • Phone: (215) 967-5171

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INTRODUCTION

Vermonters generally think of themselves as independent; able to rely on their own ingenuity and hard work to see them through any situation. Historically, this has been true, particularly in food and agriculture. During the last century, many Vermont farms not only produced all their own food and fiber, but they also produced commodities that were marketed throughout the United States and Europe. But during the latter part of the nineteenth century, as the nation's production centers moved west, Vermont lost much of its agricultural importance and became dependent on distant sources for fuel, feed, seed, and machinery.[1]

Some sectors of Vermont's food system have remained strong, and in some cases have expanded. Vermont's sucessful dairy industry developed after the sheep industry moved to the western rangelands. Vermont is an important producer of dairy products, maple syrup, and apples and is the largest producer of beef in New England.

But there are weaknesses in the system:

* 73 percent of the food consumed in Vermont is imported
* erosion persists as a serious problem in some areas
* Between 17,000 and 20,000 acres of crop and pastureland are converted to non-agricultural uses each year.

Vermont has the capacity to meet more of its own food needs using new and existing methods of farming and available farmland. It is now more important than ever to understand our food system so that we can plan for future food needs and sustain a healthy food and agriculture system. This report is a step toward that

understanding.

Each heading in the Table of Contents is worthy of a whole publication in itself. Indeed there have been previous reports on energy, erosion, and farm economics. The object of this report is not to present an exhaustive study of each complicated component of the food system, but to outline the system itself: its magnitude, complexity, and potential for change.

FOOD IMPORTS

Look into your shopping cart some time and notice where your food is coming from; lettuce from California, pork from Illinois, oranges from Florida, beef from Iowa, canned peas from Minnesota, vegetable oil from Ohio, and rice from Texas. But what about Vermont, your home state? Where are the foods produced by Vermont's farmers, on Vermont's farmland? Well, there's milk, of course, and other dairy products, and maple syrup, and maybe during the summer months there are local strawberries and lettuce. On the whole however, Vermont doesn't seem to be doing a very good job of feeding its residents.

According to the food imports chart, (See Appendix I) 73 percent of the food we eat is imported from other states and countries. Few Vermonters realize that tonight's beef stew is mostly imported from other states: 98 percent of the beef, 91 percent of the carrots, 64 percent of the potatoes, and 95 percent of the onions. Even though we grow 49,980,000 pounds of apples, we still import 43 percent of the apples we consume. Over three quarters of our cabbage comes to us from as far away as Texas. And because Vermont has few food processing facilities, we import all of our canned and frozen foods, all of our vegetable oils, and all of our flours.

By importing so much of our food, we are actually exporting our food dollars. Each year, Vermonters spend over $370,000,000 for foods grown out of state. Since only about 29 percent of our food dollars stay with the state's food retailers, (grocery stores, restaurants, etc.) Vermonters are sending over $265,000,000 out of the state every year to pay for imported food.

Part of the money that leaves the state for imported food pays for transportion, over $19,000,000 in Vermont's case. Anyone who's ever been faced with limp lettuce or rock-hard tomatoes knows that imported foods aren't always as tasty as locally grown foods.

Admittedly, there are some foods that just won't grow in Vermont's climate. We will always import our citrus fruits, bananas, pineapples, coffee and cocoa. There are many foods that can be grown in Vermont, or are already being grown in small quantities, that can lessen our dependence on food imported from other states.

It is important to understand that it is possible to retain many of our export dollars if we choose to spend them on Vermont goods. Simultaneously, we must decide to raise and process more of our own food in Vermont.

Since Americans - Vermonters included - enjoy an unusually wide diversity of foods compared to our ancestors or other nations, there are a certain minimum number of food items that we would import even if all of the meats, grains, and vegetables that can be made to grow in Vermont were grown and processed here. It would be very useful to know this minimum amount so that we could know exactly how far we moved in a given year toward or away from our most self-sufficient stage.

THE LAND

There are 6.15 million acres of land in Vermont,[2] a loosely organized patchwork of old, and cultivated fields, northern hardwood forests, softwood plantations, water bodies, private, state, and federal recreation sites, and a few urban centers. However, the vast majority of this land, 75 percent, or 4,200,000 acres is forested. Figure 1 portrays graphically the vast proportion of forest to other land uses. Forest acreage is increasing each year. This is a reflection of the hilly landforms and a shrinking agriculture, based in dairying, which has steadily consolidated operations onto the flattest, most accessible, and most fertile farmland.

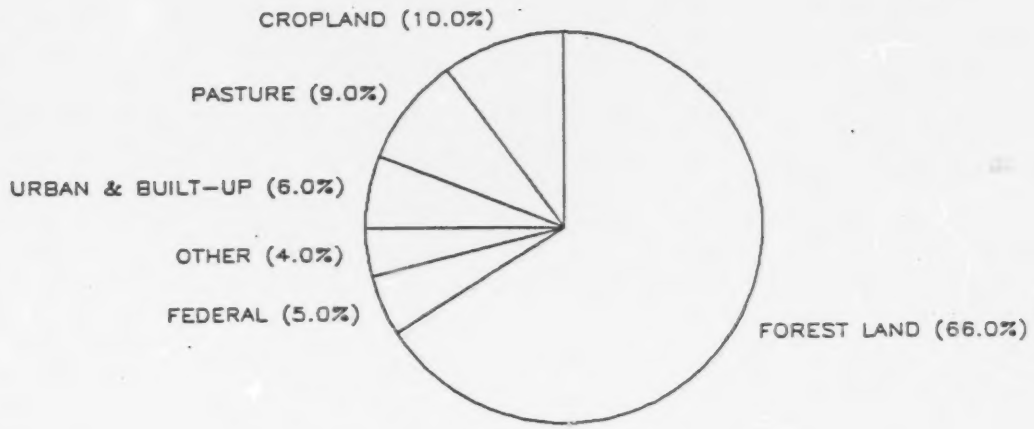
Only five percent of all lands -- most of it forest -- are federally owned. Most of that is contained in the 293,883 acres of multiuse National Forest.[3] Nearly four million acres of forest, or 65 percent of the state, is non-federal.

The next largest category of land use is cropland, estimated at 597,000 acres, about 10 percent of Vermont's land area. This is mostly corn and hay, which is used for winter cow feed. Pasture takes about 534,000 acres, or about nine percent. About 10 percent of the state's land is built on, paved, unused, or covered with water.

According to the Soil Conservation Service National Resources Inventory of 1982, Vermont has 335,600 acres of prime farmland.[4] Prime farmland by SCS definitions is composed of soils with a high potential for agricultural use. However, according to Vermont's Land Use and Development Law, Act 250, "primary agricultural soils" include those with high and good

Figure 1

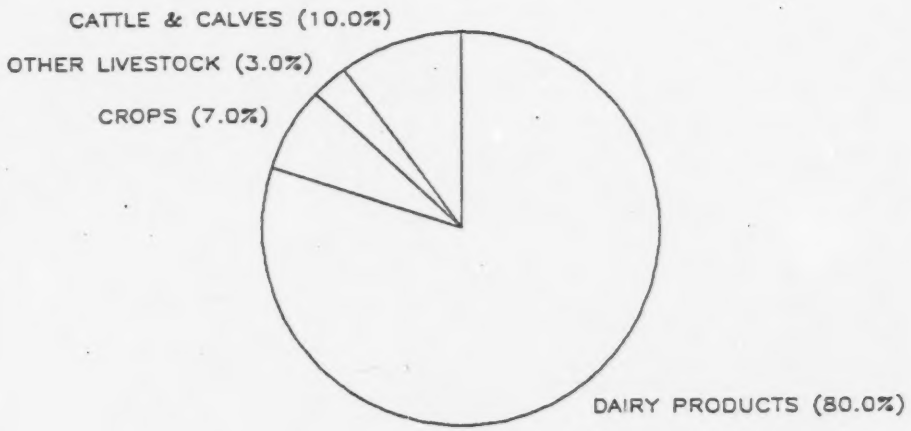
Vermont Land Use
1977



Source: The Changing Vermont Landscape: A Resource Inventory Report.

FIgure 2

Vermont Cash Receipts from Agriculture
1980



Source: Agriculture in Vermont, 41st Biennial Report to Commissioner of Agriculture.

agricultural potential.[5] This comes to just over 20 percent, or 1,182,000 acres.[6] The intention of Act 250 was to protect from development as much existing or potential farmland as possible. This is why both categories were placed under the heading "primary agricultural soils". We do not know all the reasons for the decrease in cropland, or to what extent Act 250 has protected farmland.

Depending on which inventory one relies on, harvested cropland decreased from 1967 to 1977 at an annual rate of 10,000 to 15,000 acres. Cropland and pasture land combined diminished by 17,000 acres and up to as much as 22,000 acres per year. This is roughly an area the size of Vermont's biggest city, Burlington.

In 1979, Vermont farmers spent over $90.3 million for feed.[7] In that year farm production expenses were $285.6 million (over three times the 1950 costs), so that nearly 32 percent of the money leaving the farm was for feed. A wise choice for farmers in the coming years would be to grow more feed in the state. But, to allow for this possibility it is crucial that we keep "high" and "good" agricultural lands open. However, the current trend among dairy farmers is to purchase more feed and to pasture their cows less. The reason for this is the higher volume and butterfat count from cows on processed feed diets. We will have to wait and see if this trend continues, and how it will affect the use of land now in pasture and fields.

EROSION

Agriculture is impossible without well-maintained soils. Good agricultural soils contain the correct balance of nutrients, trace minerals, organic matter and water. Formation of these topsoils requires hundreds of years, destruction can occur in a single growing season.

Erosion by wind and water can have devastating effects on topsoil. Soil is physically removed by the action of water and wind, only to be deposited in less desirable locations. Organic matter and nutrients are leached out of the soil by water erosion.

Generally, agricultural land that is losing less than five tons of soil per acre will probably maintain itself and keep crop production levels consistantly high. Soil losses of over five tons per acre will eventually lead to reduced crop yields, until it is no longer profitable for farmers to grow their crops on these badly eroded lands. Restoring land to its optimal productivity is a lengthy and expensive process.

In Vermont the "allowable soil loss" is about three tons per acre, per year.[8] This figure, however, is general, and not specific to topography, microclimate or bedrock conditions. The National Resource Inventory estimates put sheet and rill erosion on all cropland at 831,100 tons per year, or 1.3 tons per acre. The erosion rate on cultivated cropland is somewhat higher, at 4.4 tons per acre[9]

Currently, erosion on Vermont's agricultural land is not a problem. The recent trend toward no-till and minimum tillage farming will help keep erosion rates low, thus conserving this

important and almost irreplaceable resource.

The Extension Service and the Soil Conservation Service have done a great deal toward teaching farmers how to better manage hillsides better, thus reducing soil erosion.

FARM SIZE AND NUMBERS

In 1981, there were 7,900 farms in Vermont. Although this is only a quarter of the number at the turn of the century, in the past eight years or so the number has been gradually increasing each year.[10] Since 1977 an average of 300 farms have been added annually to the state's agricultural base.[11] However, total land in farms has been steady at about 1-3/4 million acres. This means that average farm size, which is now about 220 acres, has been decreasing by about 12 acres per year in the same period.

These patterns are matched very closely by the other New England states. In 1980, there were 30,360 farms in New England, a steady rise since 1970; but the average size has decreased regionally a few acres per year, with the total number of acres in farms currently at 5,145,000.[12] Table I shows the trends of farm numbers in Vermont since 1850.

Dairy farming is by far the largest sector of agriculture in Vermont. There are over 3,000 dairy farms in the state, ranging in size from 10 cow to 500 cow herds. Other types of farms do survive, however, and perhaps Vermont, more than many states, is a proving ground for diversified, year-round small farms. The smaller size, but increasing number of small farms would indicate that more people are entering farming. Figure 2 shows the

distribution of cash receipts in Vermont agriculture. What this chart emphasizes is that Vermont farming, which exports so much of its dairy production (and therefore its crops) is primarily oriented toward the state's export economy rather than its population's food needs.

While there are no figures available on part-time farming, it appears that it is increasing. The larger number of small farms would indicate this. Also, the increase in lamb and wool production in the past few years probably reflects an increase of part-time enterprises, since sheep farming is often a small and part-time occupation.[13] The implications of increased part-time farming are important: more farms help keep the state's agricultural land in production and can produce food and fiber for local markets.

Until another resource inventory is conducted, it will be difficult to tell how rapidly we are losing our cropland. However, between 1967 and 1977, Vermont cropland and pasture (combined) declined at an estimated annual rate of 17,000 acres.[14] Clearly, the increasing numbers of small farms are not offsetting the loss of fields.

Perhaps the most dangerous consequence of this trend is that the critical land mass required for supporting agricultural communities is eroded.[15] If in fact small farms are increasing, then their diversity - wool, lamb, fruits, vegetables, dairying - will enhance critical land masses. Also, a certain minimum number of farms is required to support machinery, feed and grain operations, creameries, processing facilities, and other agricultural support industries.

FARM ECONOMICS

Farm real estate debt puts a tremendous strain on farm economies, and young farmers are often hardest hit. As a case in point, the last available 1982 FmHA loan in Vermont was given to a young couple with five children, who started a 50-cow dairy operation. The amount they owe is $300,000.

The burden of payments and interest on a loan of this size is characteristec of what young dairy farmers are faced with today. In addition, stress accompanies the financial obligations, upsetting farm families and rural comunities.[16] As a result, many talented young farmers are discouraged from entering the business.

Statistics in Vermont farm production expenses show that the interest on farm mortage debt for 1979 - the last year for which statistics are available - was $13.2 million. In 1980 the outstanding debt in Vermont farm real estate and equipment was $191 million, an average of $24,177 debt per farm.[17]

Depreciation accounted for nearly $50 million, and taxes another $14 million in 1979. The costs of operating farms in Vermont include feed, fertilizer, seed, stock, lime, labor and repairs, all of which cost $210.9 million. In all, the total production expenses were $285.6 million in 1979. Gross income for the same year was $385.7 million, so farmers realized a $100.1 million net income. The average net farm income was $15,384[17] (Compare this with average farm debt.)

The average net income per farm must be seen in the context of a wide range of farms in Vermont, some very small and some very large. For example, the value of agricultural products sold

by farmers having sales of less than $2,500 in 1978 was $2,179,000. There were in that year 2,423 farms having sales in that range. By comparison, in 1974 there were 1,000 fewer farms in this economic bracket.[19] At the same time, the number of farms with sales between $10,000 and $40,000 dropped from 1,759 in 1974 to 1,201 in 1978. In 1979 there were only 135 farms with sales of $200,000 or more. The value of the products from these farms totaled $45.3 million. The largest number of farms have a $40,000 - $100,000 sales ranges. There were 1,670 of these farms with sales totalling $108 million.[20]

Again, the statistics indicate that the small farm is on the rise in Vermont. Note that the average net income per farm is affected by this increase, as well as by an increasing profit margin of the larger farms.

PESTICIDES AND CHEMICAL FERTILIZERS

In 1981 335,000 pounds of pesticides were applied to Vermont's fields and orchards.[21] Over three thousand private and commercial products were used to spray or dust an average of 0.6 pounds per acre. Nationally, pesticides are used at a rate of two pounds per acre.[22] Pesticides that are carelessly or improperly applied can drift from their point of application, contaminating water supplies or killing beneficial insect populations.

In 1982 Vermont farmers used 54,288 tons of commercial fertilizers on their fields, or 167 pounds per acre, far above the U.S. average of 111 pounds per acre.[23] This amount has been fairly steady in the last ten years, but since the annual loss of cropland during that same period has been about 10,000 acres per year, the rate of fertilizer use has actually increased by approximately one and one-half to two percent each year.

Utilization of cow manure for cropland fertilizer in Vermont is probably close to 100 percent, but the practice of spreading in winter leads to high nutrient losses due to surface runoff. A compound effect of this is a large, non-point source of pollution to streams. Winter spreading will continue until habits change, new knowledge is disseminated, and manure storage facilities are commonly understood as cheaper in long-run costs than the purchase of commercial fertilizers.

The use of cover crops or "green manures" is not widespread, but is a practice which is gaining popularity, with small farms setting the example. Perhaps this is due to the fact that a

large number of fields are rented by the larger farmers, and the growing season is short, so that farmers perceive the time to grow a cover crop, and the tractor time to turn it under, as wasted. The easy alternative is to apply commercial fertilizers, even though they are expensive. However, the indirect costs that these chemicals have to the soil, and to food quality, are rarely computed. It's difficult to put a price tag on the long-term benefits of careful land stewardship.

ENERGY

Vermont farms are intensive in their use of energy. Most of this energy is spent in dairy, apple, eggs and poultry, and maple sugar production, which in 1973 comprised 95.2 percent of Vermont's agricultural receipts.[24] In 1978 the most recent year for which statistics are available, total energy expended in crop production (including the energy to process commercial fertilizer and pesticides) was 3,160 billion BTUs.[25] In the production of livestock, 959 billion BTUs were used. Most of this energy was in the form of diesel fuel, gasoline, and liquid propane gas; electricity and fuel oil were used in relatively small quantities.

Dairy farming, which accounts for 80 percent of Vermont's cash receipts from farming, is an energy intensive industry. In one study, direct inputs to a small dairy operation included labor, feed, fuels, seed, and the purchase of stock. These inputs represented 1,292 billion calories. Output from the system in food was only 147 billion calories; waste (heat, dead stock, manure) accounted for 1,002 billion calories[26].

Other reasons why agricultural energy inputs remain high in Vermont are the high energy requirements for converting maple sap to sugar and syrup, and for maintaining apple orchards. The egg and dairy industries rely heavily on processed feeds and fuels. Also, agricultural industries are tending toward increased mechanization - more automated milking parlors, automatic poultry feeding systems, - and the substitution of machinery for human labor occurs at a high energy cost.[27]

Vermont's agriculture is not based in primary production

as are the grain and vegetable producing states. Cows and chickens are primary consumers. If Vermont could increase its production of grains, cereals, and vegetables, that is, substitute primary production for primary consumption, it could reduce some of its dependence on outside food and fuels.

In the same study, Burrill and Nolfi make a distinction between cultural and non-cultural energy. An agriculture that is a primary energy consumer relies on many cultural energy inputs since machinery, heating, and cooling are necessary for production.

The cultural energy includes an accounting of all energy costs in finding, producing, upgrading, and transporting energy inputs to machinery and chemicals. Thus, a process that appears to be more energy efficient -- using a tractor instead of a horse in hauling sap from the sugar bush to the boiling house -- may be more energy extensive when all indirect costs, such as manufacture of the tractor, are accounted for. One result of this accounting method was that dairy farms, because they depend on imported feed, consume 60 percent of the overall energy input for Vermont agriculture. By using more on-farm inputs, and adjusting the scale of operations, dairy farms can improve efficiency. The authors of "Energy Utilization in Vermont Agriculture" report that a small dairy farm of between 25 and 42 cows, especially if it uses a high proportion of feeds from hay and pasture, is the most efficient size and produces a greater total food output per cow.[28] In Vermont, however, dairy farms continue to grow in land acreage and herd size. This poses

serious questions for Vermont's energy future, and the stability of the dairy industry.

Many experts believe that the energy shortages of the 1970's will eventually return. Vermont's farming community must develop a food system that uses energy as efficiently as possible.

LAND CAPABILITY
AND
VERMONT FOOD CONSUMPTION

Any projection of the capability of a state's land to produce sufficient food for its population assumes a number of important factors, and may overlook many others.

One of the most problematic assumptions in determining a state's food production capability is diet. It is possible to supply the nutritional needs of Vermont's small population on the available land.[29] Serving the demands of the consumer is very difficult, given the broad range of foods to which we have become accustomed. It is an irony of our national system of distribution, and the unparalleled variety of processed and packaged foods in our country, that nutritional needs and food desires may have little to do with each other.

Nevertheless, it is necessary for us to know how much food our land can supply. There is more land that could be put into production. Vermont could then raise more of its own food. In the past, Vermont was self-sufficient and at different times in history produced huge surpluses of commodities that could be exported, the most famous being sheep: in 1840, there were over a million and a half head.[30]

In that same year, there were 384,000 beef cattle, more than at any time since. Maple syrup production reached a peak in 1930 at one million gallons; in 1981, only 545,000 gallons were produced. In other words, 50 years ago small sugaring operations made much more maple syrup than is produced by a few producers

today. The same is true for apple production, 7,205 farms reported harvesting apples in 1900; in 1970 only 76 farms reported a harvest of apples.

Threshed oats were grown in Vermont also. The peak of oat production came in 1880, at almost 3.6 million bushels. In that year buckwheat production was a record at 356,000 bushels. Small fruits were at their peak from 1910 to 1940, when strawberry production reached 661,000 quarts in 1940.

This data, along with a review of other production statistics since 1840 (the first year of the agricultural census) indicate certain trends: a decline in grain production from 1840-1850 with a recovery, or in some cases a peak, during 1870-1880; an increase in dairying and hay crops corresponding to a rise in the number of cows, followed by an increase in corn for silage when feeding practices changed; a steady decline in sheep and wool production, with a recent rise; fruit production peaks in 1900-1920, again in 1940, then a decline. In general though, production has exhibited a pattern of steady decline, a consolidation into larger farms and orchards, and a concentration of production on only the better farmland.[31]

This decline is not irreversible, however. Vermont still has the capability to produce more food. Using Vermont's yields per acre for fruits, vegetables and livestock feeds, it is possible to come up with an estimate of the amount of land required to produce one hundred percent of Vermonters' consumption of most foods. The last column of the Food Imports Chart (Appendix I) indicates that roughly 590,500 acres of crop and pasture land would be required to grow all of the foods that

Vermonters eat (and can be grown with Vermont's relatively short, cool growing season.)

This estimated land capability should be viewed with some caution. First of all, it is based, in part, on national per capita consumption figures. In fact, Vermonters' food consumption patterns can vary substantially from the national figures. In particular, Vermonters appear to consume less meat and more dairy products than the national averages would suggest.

Second, although it may be possible to grow our entire consumption of any particular food, providing year-round consumption of these foods is another story. Growing a year's worth of lettuce in June, for example doesn't make sense when consumers want to be able to buy lettuce all year round. Most fruits and vegetables can be preserved or stored in some fashion, if adequate facilities are available and if consumers are willing to purchase these foods.

A third factor is home garden production. The 1983 National Gardening Survey estimates that 38 percent of the households in the East had vegetable gardens in 1983. This means that approximately 72,546 of Vermont's 190,910 households had vegetable gardens. The average size of these gardens was 505 square feet. An investment of thirty dollars in seed and materials produced an average 400 dollars in vegetables for each gardening household. All told, this means that Vermont's home vegetable gardens covered a total of 841 acres and produced a whopping 29 million dollars worth of food.[32]

Last, in order to grow more food for in-state consumption,

Vermont's farmers would need to learn new farming techniques, and would need to acquire the correct equipment and facilities. This type of transition would also require the development of in-state processing, storage, and marketing facilities.

These are not, for the most part, insurmountable obstacles to increased food self-reliance in Vermont. Instead, they represent some of the many components of a complex system that needs to be thoroughly examined before large-scale changes can be made.

THE CONTEXT OF FOOD IN VERMONT AND WHAT'S BEING DONE

In 1983, a record amount of rain fell during the spring, saturating fields and making them inaccessible to tractors. Just as the critical planting dates were approaching -- after which the corn would not ripen before Vermont's early frost date -- a University of Vermont agronomist said "We're going to see if there is even going to be an agriculture in Vermont."[33] He was referring to the fact that many Vermont dairy farms would go out of business if forced to buy feed through the winter.

It is important to understand the context of growing food in Vermont in order to appreciate why we don't grow more of it, and why people are reluctant to try. The short growing season is only the most obvious hindrance to a vigorous agriculture in Vermont. There are other limitations, though, which make farming and the production of our own food very difficult indeed. By far, the biggest of these difficulties is the market for our products.

Vermont is on the end of the supply lines that distribute food from Albany, Springfield, and Boston. Being in this position, we are particularly vulnerable to a transportation breakdown, an oil shortage, or some other event that would lead to a food crisis. This also creates a disadvantage in marketing products. Many of the potentially lucrative agricultural products produced here -- lamb, honey, maple products, produce -- are difficult to distribute efficiently to distant markets; and the domestic market has not proven satisfactory.

Farmers, academicians, and researchers agree that raising the products is not a problem, but that marketing them is. Nevertheless, the age-old question stands: will growing more products create markets; or do markets have to be started to stimulate production? This question can be argued both ways. Successful growers say that you must make your own market and create a demand for your product. Other expert growers insist that we must encourage Vermonters to buy Vermont products, that consumers must be made aware that every choice they make in the market affects agriculture in Vermont.

Much work has been done in market innovations in Vermont. One notable study is the Connecticut River Valley Agricultural Project.[34] This study looks at the demand and projected demand for fresh fruits and vegetables based on population and household trends; the alternative outlets for produce, from retail and direct selling, to wholesale shipping to Boston; and marketing requirements like precooling, packaging, and storage lives. The great value of this study is that it specifies all these requirements for each vegetable and fruit.

The Connecticut River Valley is a fertile area with a growing population and good access to urban centers, so it was an ideal area for a pilot study. The Projects findings are very useful for growers everywhere. The methods used in this study should be used in other marketing regions. An added benefit of the Project were two workshops, one on quality standards demanded by grocers, and the other on extended season production techniques.

Out of the Vermont Department of Agricultural has come the Seal of Quality Program. Any producer whose agricultural produce

meets the Program's standards is eligible for a state-certified seal, which indicates to the consumer that the product is of the highest quality-oriented agriculture in Vermont. Recipes and posters are also widely distributed. Figure 4 shows the Seal, as it appears on the packaging of quality Vermont products.

Figure 3

The Vermont Seal of Quality

SYMBOL ASSURES BUYER THAT PRODUCT MEETS HIGHEST QUALITY STANDARDS

Recently, a Source Book for consumers was compiled, listing producers, availability of their product, terms of sales, and delivery area of all Vermont products. This manual is the product of the Agricultural Promotion Board of the Department of Agriculture.

At the University of Vermont, marketing economists like Neil Pelsue continue to research and design methods of marketing Vermont's products, but, the problems of how to profit from farming in Vermont have not been solved.

Closely related to the central difficulty of marketing is the lack of in-state processing facilities. Aside from cheese

processing, milk drying, and cider pressing, there is very little or no processing of meats, vegetables, or fruits.[35] Again, this reflects both sides of the issue, low production and lack of markets.

One successful venture has been the non-profit Cherry Hill Cooperative Cannery in Barre. Originally a facility to assist home growers wanting to preserve their harvest, the Cannery now markets apple sauce, apple butter, maple syrup and other products for markets as far away as California. Last year's sales approached a quarter-million dollars, and this year the Cannery is experimenting with new products including saurkraut and fiddle head ferns, a Vermont specialty.

The Vermont Sheep Breeders Association organizes slaughter schedules, enabling growers to store and ship in bulk. The Association is also gaining access to specialty outlets and ethnic markets where lean Vermont lamb is popular.

In order to preserve farmland and protect our future potential for food production, several legal devices have been devised by the State legislature. (See Appendix II.) Private groups have also been successful in preserving farmland. Most important is the Ottauquechee Regional Land Trust, which protects more agricultural and forest land than any other statewide organization.

Perhaps the subtlest and most serious obstacle to increased food self-reliance in Vermont is diet. Consumers have become accustomed to the wide variety of foods that cheap transportation has brought to New England. The unseen tragedy is that food

imported from other states displaces local production. Frozen orange juice concentrate that is shipped to Vermont from Brazil and Florida displaces local apple cider or tomato juice as a breakfast beverage. Midwestern beef diminishes the market for local beef producers. Vermont's consumers have become accustomed to a diet which includes a number of foods that cannot be grown in Vermont, or can be grown for only part of the year. Vermont has the capability to produce a wide variety of foods that would provide the state's consumers with a tasty, nutritious, varied diet. Surely, making Vermont an economically stronger, more self-reliant state is worth the changes and adaptations an improved food and agriculture system would entail for Vermont's consumers, producers, processors, and retailers.

RECOMMENDATIONS

There are three objectives to the following recommendations:

1. to foster a viable agriculture for Vermont;
2. to encourage a high standard of nutrition for Vermonters;
3. to lesson dependence on imported food.

For these objectives to be met, it is crucial for consumers, business people, lawmakers, and visitors, to remain open in their expectations of agriculture. We all must reconceptualize our traditional ideas about how our food gets to us, and what Vermont looks like. As farming must change in Vermont, so must the landscape. Farming has always adapted to changing circumstances. Until now, farms, as the backbone of rural communities, have been responsible for creating the especially beautiful landscape, and the marvellously intricate social fabric of Vermont. Because of Vermont's growing population and the fact that the national economy affects farmers more and more, the coming decades will give rise to a different farming pattern. This will probably consist of more small farms, increased part-time farming, a more competitive dairy industry, and more vacation homes amongst the ever increasing forest.

This is not to say that Vermont will become ugly, poorer, or more dependent. On the contrary, if people in Vermont take responsibility as individuals and as communities, to keep fields managed, to raise vegetables and meat, to buy locally, then more houses will mean more small farms, home food production will privately subsidize more incomes, and our regional food system

will be more secure. In any future emergency, we will be able to respond immediately.

This is not to say that Vermont should ignore the economic realities in the United States, or the trends in international development, and turn away clean industry which it has successfully recruited. Indeed, this recruitment should be encouraged to stimulate incomes and stimulate spending on Vermont products. Vermont is one edge of a double-edged sword carving a way for the future: on one side, externalities like communications, increasing productivity of labor relative to capital, global shifts in the resource base, and the increasingly independent economies of the multinational corporations; on the other side, a recognition of limits, an acceptance of small-scale economies, an understanding of indirect and external costs to the environment, social constructs, and human health. Vermont is of the second category, a compliment to the megalopolis of the eastern coast. The New England region is moving toward these new understandings.

"Individual," and "community," are key words. The federal government will not subsidize farming in Vermont. The state will not buy maple syrup or organic produce, our neighboring consumers will. Therefore, any commitment we make toward strengthening our food system, and our lives, should be viewed as a policy decision affecting the nation and the world.

The bottom line is making a living and eating nutritiously. There is absolutely no reason why we cannot meet these needs through understanding and becoming more connected to our own food system. At the same time we can end hunger in the state, create

new markets, and make a model out of Vermont's rural economy.

Toward that end, this series of recommendations has been compiled from recommendations culled from several reports and this research.[36]

RECOMMENDATIONS TO CONSUMERS

1. Become more involved in your food system: learn where your food comes from, make an effort to read about the nutritional content of foods.

2. Ask for locally-grown meats, produce, and eggs at chain stores, as well as at small markets and restaurants. This will help create local markets for local goods, and help reward small and family farmers for what they do most competitively, which is to produce an exceptionally high quality product.

3. Make an effort to shop at farmers' markets and roadside stands.

4. Learn to adjust your diet seasonally instead of shopping for the same foods at the same supermarket year-round; try to unlearn the expectation of a perfect fruit or vegetable -- this has lead to energy-intensive spraying and packaging.

5. If you have the space, start a home garden and/or greenhouse to produce more of your own vegetables, to create a healthy recreational alternative, and to teach children about gardening. By taking some control over your own food you assume more responsibility for your own and your family's health, as well as provide for your safety in the event of a food shortage.

6. Try to improve and maintain your health by eating less fat, salt, sugar, and cholesterol while eating more fiber and vegetables; it is possible to reduce our dependence on imported grain by up to ten times the average U.S. consumption simply by eating less meat.[37] This also brings our diets more in line with the regional food producing capacity.

RECOMMENDATIONS TO FARMERS

1. Take advantage of existing laws, (see Appendix II) including the Right-to-Farm law, Use-Value Appraisal, Aquisition of Interests in Land, etc. These programs are designed to encourage, and keep, farming in Vermont.

2. Learn about alternatives for the future use of your land, such as land trusts (the Ottauquechee Trust, for example).

3. Preserve farmland by reducing erosion: take advantage of Soil Conservation Service technical assistance and cost-sharing programs; use winter cover crops, crop residues, hedges, contouring and minimal tillage to retain topsoil.

4. Develop more on-farm fertilizer sources by growing nitrogen fixing legumes and green manure crops like buckwheat and oats.

5. Avoid routine spraying: apply pesticides only when they are needed, use appropriate sprays to avoid killing beneficial insects and soil micro-organisms.

6. Consider alternatives to repeated pesticide application, including integrated pest management, no-till, crop rotations, companion and interplanting, and organic soil practices to induce vigorous plants.

7. Support local newspaper coverage of farm problems with letters to the editor, and encourage reporting of farms and farmers (like the 1983 series in the Times-Argus by Tom Slayton.[38]

8. Make an effort to attend workshops and conferences given by state agencies, U.V.M. extension personel, and private

groups.

9. Support agricultural legislation by writing state and national congress people. Update memberships in lobbying groups like the Farm Bureau or the Natural Organic Farmers Association (See Appendix III for a list of Organizations.)

10. Continue to explore new ways to increase farm efficiency. This might mean more on-farm inputs, more labor-intensive methods instead of high-overhead machinery, and a return to smaller herds:[39] or the possibility of a private marketing management group to assume marketing responsibilities among several farms.[40] Marketing is a specialized field which takes up an inordinate amount of time for Vermont's segmented farming community. Support marketing groups that already exist, like the Northern Growers Co-op in Hardwick.

11. Consider diversification or vertical integration of the farm business, like breeding/milking, or growing/retailing, or agriculture/sugaring, and seek technical advice.

12. Demand more state-funded research like the Connecticut River Valley Agricultural Project.

13. Extend your market season for the convenience of buyers and your own flexibility.

14. Demand further investigation into the possibility of a grain-storage facility in the state. By buying unit train lots of grain, costs of grain for dairy, poultry, and live-stock farmers would be kept at the lowest possible prices.[41]

RECOMMENDATIONS TO THE STATE

Based on available information and conversation with growers, researchers, administrators and consumers, we recommend:

1. That the State Department of Agriculture be assigned the primary role in developing and implementing agricultural policy, and that the Department be renamed the State Department of Agriculture and Food to reflect a concern with the entire food system.

2. That the Office of the Governor establish an Agriculture and Food Policy.

3. That the Department of Agriculture develop a consistent, accurate method of calculating food imports.

4. That the Agency of Development and Community Affairs conduct a feasibility study of a dehydration processing plant for the processing of agricultural products. Food processing facilities would help stimulate a more diversified agriculture by serving a wider market in Vermont and in New England. Freeze-drying and compression of foods is an advanced technology with possible commercial applications in this region.

5. That the State continue, and escalate, promotion of farmers' markets and farmer-to-consumer direct sales. A State-sponsored farmers' market newsletter might be one possibility for maintaining a flow of information on prices, innovations, and products between farmers, promoters and coordinators.

6. That the State require nutrition and consumer education, to be given for credit at all levels of tax-supported schools.

7. That the State develop plans for a pilot project on municipal composting to reduce our dependence on outside sources of fertilizer and to begin an enlightened program of efficient waste disposal. Tied to this could be incentives for industry to separate toxic substances from waste so that they might be safely utilized for crops.

8. That the State take a more active role in encouraging all citizens not to allow land to go out of production or to be overgrown, since the high cost of renovating farmland is perhaps the chief reason why more prime land is not reopened.[42]

9. That the Department of Agriculture continue to provide meat inspection services, and work toward elevating those services to the highest level of integrity in order to preserve present slaughterhouses, which are essential for local meat production.

10. That the Department of Agriculture continue to fund in-depth marketing studies, like the Connecticut River Valley Agricultural Project; orchardists, stockmen, aquaculturists and beekeepers could also benefit from this research.

11. That the State Legislature and the Executive Office increase their dialogue on tax reform proposals favorable to the retention of farmland. A "right of first refusal" law is one possibility. This is an option currently in use in France where owners of farmland in designated areas must by law notify a state-chartered non-profit corporation of their intention to sell, and the corporation has a 30 day option to buy.[43]

12. That the State Extension Service implement a program of workshops on farmland retention techniques, for farmers and

townspeople.

13. That the Extention Service devote more time to public educational and training programs, and that the Experiment Station conduct more research on organic agriculture specifically adapted to Vermont.

14. That the Extension Service and the Experiment Station become increasing active in home and community food production, especially in the area of grain crops for human consumption. Crops furnish over 90 percent of our calories and about 66 percent of our protein, [44] yet the State improts 99 percent of its grain. The market for grains is currently developing through food co-ops.

15. That the State continue to research the feasibility of a wholesale produce market, perhaps in co-ordination with New Hampshire.

16. That the State consider the possibility of hiring a marketing specialist as a trial for an ultimately farm-supported specialist, to handle the marketing of products from a given area. The market is competitive, demanding, and unsympathetic, and it is the largest single obstacle to an increased and diversified agriculture in Vermont.

17. That the State implement a mapping program to identify all land that should be protected from development by virtue of its agricultural potential; all class I and II soils would be charted. (California is currently mapping its important agricultural land base.) Such a map would be useful also to Act 250 district commissions who presently have no uniform guidelines

on which land should be protected.[45]

18. That the appropriate State agencies link economic programs such as loans, crop insurance, disaster relief, cost-sharing, to the control of excessive (over 3 tons per acre) soil erosion on farmland.

19. That the Department of Agriculture should work toward promoting a new identity as a supporter of small and diversified farming, not just big-business dairying.

RECOMMENDATIONS TO THE FOOD INDUSTRY

1. Help to cut superfluous costs in the food system by de-emphasizing produce appearance through packaging and emphasizing freshness and nutritional quality.

2. Section off a Vermont products section in chain stores; take advantage of the "Seal of Quality" program and promote the quality of Vermont foods.

3. Provide consumers with nutrition education, hints for food preparation, and techniques of putting food by.

4. Help educate consumers in the origin of their foods by providing point-of-purchase literature and by using wall maps illustrating state of origin of foods.

RECOMMENDATIONS TO THE RESEARCH COMMUNITY

1. Assess the relationships between biofuels development and long range soil productivity, and develop guidelines for future development.

2. Investigate further uses of forages and crop wastes.

3. Continue to research small-farm systems, especially market outlets for the wide variety of products they produce. Small farms set an example for using appropriate-sized machinery that minimizes soil compaction, cuts farm debt, and reduces fuel consumption.

4. Expand projects looking at livestock management and alternative home-grown forages, especially for beef, the most intensive consumer of imported feeds.

5. Explore the potential for aquaculture in Vermont, since 70 percent of all fresh fish in the United States is marketed in

the Boston area.

6. Test methods of producing more food in urban areas. The Burlington community gardens have been a success; rooftop production is another alternative, especially using greenhouses.

7. Compile more specific data on Vermont diets so that more accurate consumption figures can be used in future estimates of Vermont food imports.

8. Integrate legal and tax innovations in farmland retention into the study of ecological problems like soil erosion, and economic problems related to marketing.

9. The U.V.M. Extension Service should publish booklets on organic methods in gardening and farming. Currently only a couple of publications mention organic practices.

10. Encourage student research on all of these topics, especially on future agricultural potentials such as hydroponics and permaculture.

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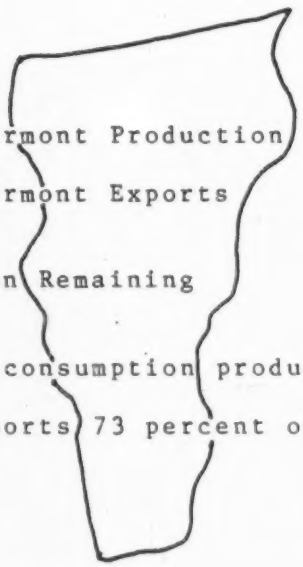
APPENDIX I

VERMONT FOOD CHART

The food and agriculture system of Vermont has a long history of success. Until the second half of the nineteenth century, Vermont not only produced the majority of its own food, but also exported its surpluses of food and fiber to other states. Today, 73 percent of the food consumed in Vermont is imported from other states and countries.

Unnecessary food imports deprive the state of valuable income, not only for farmers, but also for food processors, agricultural machinery dealers, and other food and agriculture related industries. Increased local production for local consumption would provide the state's consumers with a secure supply of nutritious food.

There are many indications that Vermont is moving toward greater food self-reliance. With careful planning and the commitment of all Vermonters, including farmers, consumers, policy makers, business people and the research community, Vermont can develop a secure sustainable food and agriculture system.



Retail Value of Vermont Production	$3,175,461,720
Retail Value of Vermont Exports	$3,039,806,250
Value of Production Remaining	$ 135,655,470

27 percent of consumption produced in Vermont

Vermont imports 73 percent of its food

FOOD IMPORTS CHART

COMMODITY	RETAIL WEIGHT OF PRODUCTION (1,000 lbs.)	RETAIL VALUE OF PRODUCTION ($1,000)	RETAIL WEIGHT OF CONSUMPTION (1,000 lbs.)	RETAIL VALUE OF CONSUMPTION ($1,000)	PERCENT IMPORTS	VALUE OF IMPORTS ($1000)	PERCENT EXPORTS	VALUE OF EXPORTS ($1000)	ACRES REQUIRED FOR 100% SELF-RELIANCE
MEATS (a)									
Beef	425.00	990.20	39,126.00	91,163.60	98.91	90,173.40			105,746
Mutton and lamb	47.00	117.03	7,160.00	17,828.40	99.34	17,711.37			62,807
Pork	1,246.00	1,619.80	34,932.00	45,411.60	96.43	43,791.80			48,924
Processed meat products	3,298.00	NC	NC						
Veal	45.00	138.20	767.00	2,354.70	94.13	2,216.50			2,148
POULTRY									
Chicken (b)	669.00	702.45	25,634.00	26,915.70	97.39	26,213.25			71,804
Turkey (c)	176.00	165.44	5,370.00	5,047.80	96.72	4,882.36			27,398
Eggs (b)	769,230.00	423,076.50	17,696.00	9,732.80			97.70	413,343.70	41,934
FISH (d)	0.00	0.00	6,546.00	15,186.81	100.00	15,186.81			NA
DAIRY PRODUCTS (e)									
Butter	9,859.00	18,534.92	230.00	432.40			97.67	18,102.52	2,300
Cheese	851,015.00	1,974,361.94	11,303.00	26,222.96			98.67	1,948,138.98	63,145
Cream	63,409.00	52,185.61	4,245.00	3,493.64			93.31	48,691.97	
Dry milk products	2,610.00	5,428.80	3,324.00	6,881.20	21.11	1,452.40			
Evap. & conds. milk	128,750.00	114,587.50	17,900.00	15,931.00			86.10	98,656.50	
Fluid milk	2,079,381.00	499,051.44	73,394.00	17,614.56			96.47	481,436.88	65,297
Frozen dairy products	3,997.00	3,557.30	13,144.00	11,698.10	69.59	8,140.80			
Skim milk	130,505.00	27,406.05	50,071.00	10,514.91			61.63	16,891.14	44,547
FRESH FRUITS									
Apples (f)	49,980.00	31,362.45	87,970.00	55,201.18	43.19	23,838.73			NA
Blueberries	114.00	86.80	199.47	151.59	42.74	64.79			92
Citrus	0.00		14,372.00	5,748.00	100.00	5,748.00			NA
Peaches	NC		307.00	156.57					NA
Raspberries	25.60	24.50	NC	--					--
Strawberries	1,904.70	1,142.00	971.00	582.60			48.98	559.40	155
Other small fruit	NC	32.00	NC	--					--

Continued

FOOD IMPORTS CHART

COMMODITY	RETAIL WEIGHT OF PRODUCTION (1,000 lbs.)	RETAIL VALUE OF PRODUCTION ($1,000)	RETAIL WEIGHT OF CONSUMPTION (1,000 lbs.)	RETAIL VALUE OF CONSUMPTION ($1,000)	PERCENT IMPORTS	VALUE OF IMPORTS ($1000)	PERCENT EXPORTS	VALUE OF EXPORTS ($1000)	ACRES REQUIRED FOR 100% SELF-RELIANCE
FRESH VEGETABLES									
Asparagus	53.80	57.57	153.00	163.71	64.83	106.14			88
Beets	146.80	47.90	NC	--					--
Broccoli	37.30	18.40	869.00	425.81	95.68	407.41			221
Cabbage	921.30	221.11	4,090.00	981.00	77.46	759.89			244
Carrots	268.60	88.64	3,222.00	1,063.26	91.66	974.62			199
Cauliflower	212.60	174.34	665.00	545.30	68.03	370.96			44
Celery	33.00	13.53	3,734.00	1,531.00	99.12	1,517.47			193
Cucumbers	299.80	143.90	2,046.00	982.00	85.35	838.10			247
Dry Beans	3.40	2.50	2,096.99	1,551.77	99.84	1,549.27			1,476
Lettuce (g)	155.80	73.74	12,684.00	6,215.00	98.81	6,141.26			1,001
Melons	189.90	24.69	8,643.00	1,118.40	97.79	1,093.71			928
Onions	209.40	59.20	4,705.00	1,317.40	95.51	1,258.20			297
Peas	159.60	95.60	NC	--					--
Peppers	86.40	68.26	1,688.00	1,333.52	94.88	1,265.26			305
Potatoes	14,700.00	2,793.00	41,428.00	7,871.32	64.52	5,078.32			2,399
Pumpkins	2,452.40	260.60	NC	--					--
Radishes	21.70	14.11	NC	--					--
Rhubarb	8.40	5.00	NC	--					--
Shell beans	29.10	12.90	204.00	89.76	85.63	76.86			78
Snap beans	126.10	90.79	716.00	515.52	82.39	424.73			262
Spinach (h)	6.30	2.90	358.00	164.68	98.24	161.78			34
Squash									
summer	281.10	66.50	NC	--					--
winter	2,278.40	471.00	NC	--			100.00	471.00	--
Sweet corn	10,499.30	3,989.73	3,376.00	1,283.00			67.84	2,706.73	403
Tomatoes (i)	850.60	654.96	5,831.00	4,499.00	85.44	3,844.04			490
Other vegetables			5,472.00	3,830.40	100.00	3,830.40			--
PROCESSED VEGETABLES	0.00		44,839.35	33,193.50	100.00	33,193.50			

Continued

APPENDIX 1

FOOD IMPORTS CHART

COMMODITY	RETAIL WEIGHT OF PRODUCTION (1,000 lbs.)	RETAIL VALUE OF PRODUCTION ($1,000)	RETAIL WEIGHT OF CONSUMPTION (1,000 lbs.)	RETAIL VALUE OF CONSUMPTION ($1,000)	PERCENT IMPORTS	VALUE OF IMPORTS ($1000)	PERCENT EXPORTS	VALUE OF EXPORTS ($1000)	ACRES REQUIRED FOR 100% SELF-RELIANCE
SWEETENERS									
Maple syrup	6,011.35	10,900.00	51.14	92.57			99.15	10,807.43	NA
Honey	405.00	469.80	562.00	651.90	27.93	182.10			NA
Cane and beet sugar	0.00		40,609.61	16,243.84	100.00	16,243.84			NA
FATS AND OILS									
Lard (j)	101.60	70.12	1,227.00	846.63	91.72	776.51			NA
Margarine	NC		5,728.30	4,238.90	100.00	4,238.90			NA
Shortening	NC		7.80	6.00	100.00	6.00			NA
Other edible fats and oils	NC		11,610.00	10,449.04	100.00	10,449.04			NA
TREENUTS AND PEANUTS	0.00		3,682.00	5,958.00	100.00	5,958.00			NA
GRAINS									
Barley	NC		523.43	324.53	100.00	324.53			337
Wheat	NC		59,840.00	14,960.00	100.00	14,960.00			42,698
Wheat cereal	0.00		1,483.00	1,447.90	100.00	1,447.90			193
Rye	NC		358.00	87.40	100.00	87.40			260
Rice	0.00		4,808.00	1,019.64	100.00	1,019.64			NA
Corn									NA
flour	NC		3,835.00	1,386.70	100.00	1,386.70			
cereal	0.00		1,176.00	1,044.80	100.00	1,044.80			
Oat products	NC		1,585.00	1,132.00	100.00	1,132.00			1,807
TEA, COFFEE, AND COCOA	0.00		5,677.00	15,324.75	100.00	15,324.75			NA
TOTALS	4,137,235.35	3,175,461.72	704,245.09	512,160.07		376,894.24		3,039,806.25	590,503

NOTES TO FOOD IMPORTS CHART

Data on crop and Livestock production is from the Department of Agriculture, State of Vermont; the USDA Crop and Livestock Reporting Service for New England; and the Small Fruit and Vegetable Survey. Consumption statisics are taken from Food Consumption, Prices and Expenditures, USDA, Economic Research Service, Statistical Bulletin No. 672.

a. Includes custom and commercial slaughter.

b. Includes on-farm consumption.

c. Production is for 1979.

d. Does not include game fish, aquaculture, or private stocking

e. Total of all milk received at processing facilities = 276,817,229 lbs.

f. Quantity sold or utilized, commercial production only.

g. Production includes leaf lettuce production of 54,500 pounds and head lettuce production of 101,300 lbs.

h. Production includes swiss chard production of 6,300 lbs.

i. Production includes cherry tomatoes.

j. Lard is a by-product of pork slaughter.

k. Barley production is given in terms of pearled barley; wheat and rye production is given in terms of flour.

APPENDIX II

This chart summarizes state laws which have been enacted to maintain and strengthen agriculture in Vermont.

EXISTING VERMONT FARMLAND PROGRAMS

Name of Program	Year Adopted	Description of Program
Right-to-Farm (Title 12, Chapter 195)	1981	State law protects normal agricultural activities (on commercial agricultural land) from nuisance lawsuits. Agricultural, horticultural and forestry crop production are included. Public health and safety must not be adversely affected.
Use-Value Appraisal (Title 32, Chapter 124)	1978	Effective in 1980, this state program allows qualifying land owners in any Vermont town to apply for use-value appraisal (rather than fair market value appraisal) of their farm or forest land. Landowners apply to local listers, although eligibility and land (use) values are specified by state law and regulations. Towns are fully reimbursed for lost tax revenues.
Tax Stabilization Agreements (Title 24, Chapter 75)	1967	Property tax relief contracts, authorized by state law and voted on by local communities. Land eligibility and amount of tax relief determined locally. Towns with stabilization receive additional state aid to education to offset portion of tax revenues lost through landowner agreements.
Growth Management and Planning (Executive Order 52 and Title 24, Chapter 117)	1980	Executive Order 52 requires each state agency to specify policies and actions to minimize development impact on agricultural land. A Review Board oversees this.
	1968	Vermont's Planning and Development Act allows towns to plan for "the appropriate development of all lands..." specifically to protect agriculture and other resources. The

Name of Program	Year Adopted	Description of Program
Growth, Management and Planning (Executive Order 52 and Title 24, Chapter 117) continued	1968	law permits town and regional plans and commissions to achieve these goals. Act also authorizes towns to adopt zoning to implement the town plan. Such regulations may create agricultural districts which permit all types of agricultural uses with limited development allowed.
Development Permits (Title 10, Chapter 151)	1970	Vermont's Land-Use and Development Law (Act 250) regulates certain land development and subdivision. If a given parcel of land contains primary agricultural soils, the Act 250 applicant must show that either the agricultural potential will not be substantially reduced, or that no physical or economic alternative exists (other than to develop the parcel), reduction of agricultural potential will be minimized, and agriculture or forestry on adjacent lands will not be jeopardized.
Acquisition of Interests in Land (Title 10, Chapter 155)	1969	State law permits a municipality or the Vermont Departments of Fish and Game, Highway, Forests & Parks, and Water Resources to acquire real property (or interests or rights to property) for the purpose of protecting Vermont's agricultural, forest and other undeveloped land. Acquisition may be purchase, gift, transfer or exchange.
Joint Resolution 43	1982	Supports the activities of private Land Trusts in the protection of agricultural lands.

SOURCE: Briefle' 1332-B, Farmland Retention Techniques, The Extension Service, University of Vermont.

APPENDIX III

There are many organizations which directly or indirectly are working toward developing a sustainable food system in Vermont. The following is a selected list of organizations working with consumers, farmers, and the food industry in Vermont.

Champlain Valley Holstein Club
Francis S. Haggarty, President
RFD #3
Vergennes, VT 05491
(802) 475-2391

Champlain Valley Milk Producers
Cooperative, Inc.
Marvin Chapman, President
Williston, VT 05495
(802) 476-4669

Dairy Council of Vermont, Inc.
Marcell Booth, President
Box 301
Barre, VT 05641
(802) 476-4669

Green Mountain Dairy Promotion, Inc.
Catherine Beattie, Chairman
Danville, VT 05828
(802) 684-3322

Milk Promotion Service, Inc.
J. Douglas Webb, President
RD 1
Fairfax, VT 05454
(802) 849-6038

Natural Organic Farmers Association
Andy Snyder, President
Fire Hill Road
Florence, VT 05744
(802) 483-2295

Northern Farms Cooperative, Inc.
Arthur Huestis, President
Bridport, VT 05734
(802) 758-2489

Twin State Milk Sanitarians
Maurice Dike, President
Creek Road
Colchester, VT 05446
(802) 878-4183

Vermont Agricultural Enterprises, Inc.
Ray W. Allen, President
South Hero, VT 05486
(802) 372-5566

Vermont Agricultural Fairs
Association, Inc.
Russell G. Wood, President
Bradford, VT 05033
(802) 222-5267

Vermont Association Future
Farmers of America
Alden Bowman, President
Niles Road
Newport Ctr., VT 05857
(802) 334-6991

Vermont Association of Teachers
of Agriculture
Richard Lutz, President
Mt. Anthony U.H.S.
Bennington, VT 05201
(802) 447-0220

Vermont Beef Producers Association
Willard L. Conant, President
Box 272
Richmond, VT 05477
(802) 434-2056

Vermont Beekeepers Association, Inc.
Fabian C. Little, President
South Hill Road
Williamstown, VT 05679
(802) 433-5562

Vermont Cattlemen's Association
Herbert C. Gray, President
East Thetford, VT 05043
(802) 785-4348

Vermont Dairy Goat Marketing
Association
Alice Hooper, President
EAst Brookfield, VT 05036
(802) 276-3107

Vermont Dairy Herd Improvement
Association, Inc.
Austin Cleaves, President
East Montpelier, VT 05651
(802) 223-2978

Vermont Dairy Industry Association
Donald Moore, President
RFD
Wells River, VT 05081
(802) 633-4944

Vermont Dairymen's Association
Willis Torrey, President
Brandon, VT 05733
(802) 247-6696

Vermont Farm Bureau, Inc.
Rupert C. Chamberlin, President
RD 1
Barton, VT 05822
(802) 525-6635

Vermont Feed Dealers and
Manufacturers Association
Kenneth Boyce, President
Box 153
Fair Haven, VT 05743
(802) 265-3029

Vermont Horseman's Council
Jean Gilman, President
Covey Road
Williamstown, VT 05679
(802) 433-5372

Vermont Maple Industry Council
Sam Cutting, President
The Dakin Farm
Ferrisburg, VT 05456
(802) 425-2448

Vermont Maple Sugar Makers
Association, Inc.
Wilson S. Clark, President
Wells, VT 05774
(802) 325-3203

Vermont Milk Dealers Association
Edward Holden, President
Fairdale Farms, Inc.
Bennington, VT 05201
(802) 442-6391

Vermont-New Hampshire Potato
Growers Association
William Rodonis, Sr., President
Hudson, NH 03051
(603) 882-1793

Vermont Plantsmen's Association, Inc.
Chris von Trapp, President
Mt. Philo Meadows
RFD 1
Hinesburg, VT 05461
(802) 482-3450

Vermont Poultry Association
Richard Paquette, President
Box 143
Colchester, VT 05446
(802) 655-2266

Vermont Sheep Breeders Association
Don Mitchell
RFD 2
Vergennes, VT 05491
(802) 545-2278

Vermont Small Fruit and Vegetables
Growers Association
Randall Hicken, President
RD 1
Brattleboro, VT 05301
(802) 257-0784

Vermont State Grange
Harold Bergeron, Master
47 Maple St.
Essex Jct., VT 05452
(802) 878-5700

Vermont Tree Fruit Growers
Association
Michael Brinkman, President
Edgewood Orchards
RD 2
Middlebury, VT 05753
(802) 462-2729

Vermont Natural Food and Gardening
Association, Inc.
Frank Kropa, President
Dorset, VT

APPENDIX IV

"PICK YOUR OWN GROWERS IN VERMONT"

1983

APPLES

ALLEN BROTHERS FARMS AND ORCHARD
RR 1, Box 325
Bellows Falls, VT 05101
(802) 722-3395

BURNHAM HOLLOW ORCHARDS
Robert & Penelope Hall
Middletown Springs, VT 05757
(802) 235-2452

CHAPIN'S ORCHARD
Star Route
Essex Jct., VT 05452
(802) 879-4025

DANIEL'S ORCHARD
New Haven, VT 05472
(802) 545-2425 or
(802) 545-2422

DOUBLE FOUR ORCHARD
Joe Cerniglia
335 River Street
Springfield, VT 05156
(802) 885-3555

EDGEWOOD ORCHARD
Michael & Jennie Brinkman
RD #2
Cornwall, VT 05753
(802) 462-2729

ELLIS ORCHARDS, INC.
Veronica Ellis
P.O. Box 295
Castleton, VT 05735
(802) 468-5031 or
(802) 468-5556

GOLDEN APPLE ORCHARD
Whalley Road
Charlotte, VT 05445
(802) 425-2060

GOODELL ORCHARD
RFD #3, Box 170
Putney, VT 05346
(802) 387-5345

GREEN MOUNTAIN ORCHARDS, INC.
Darrow
Box 225
Putney, VT 05346
(802) 387-5851

GIRFFIN ORCHARDS
Bruce Griffin
RD #1, Box 360
Castleton, VT 05735
(802) 468-5392

HACKETT'S ORCHARD
Ron & Celia Hackett
Box 239
South Hero, VT 05486
(802) 372-4848

HARLOW'S SUGAR HOUSE
Donald Harlow
RD #1, Box 100
Putney, VT 05346
(802) 387-5852

HARWOOD HILL ORCHARD
Paul W. Bohne, III
Bennington, VT 05201
(802) 442-9524

LARRABEE'S POINT ORCHARD
Wesley & Virginia Larrabee
Shoreham, VT 05770
(802) 897-2626 or
(802) 897-5553

MENDON MT. ORCHARDS & MOTEL
Charles, Haynes, Steingress
Route 4
Mendon, VT 05701
(802) 775-5477

FRANCIS MILLER ORCHARDS
Bonnyvale Road, Box 203-B
West Brattleboro, VT 05301
(802) 254-6925

PATTERSON APPLE ACRES
Douglas Atwood
RD, Barnum Hill
Shoreham, VT 05770
(802) 897-5642

SHELBURNE ORCHARD
Nicholas Cowles
Shelburne, VT 05482
(802) 985-2753

SOUTHERN VT ORCHARDS, INC.
Richard B. Montondo
Carpenter Hill
Bennington, VT 05201
(802) 442-4853

WOOD BROTHERS ORCHARD, INC.
Lewis & Warren Wood
RFD #3
Middlebury, VT 05753
(802) 388-2110

MAD TOM ORCHARD
Allen Brothers
East Dorset, VT 05253
(802) 362-4519

DWIGHT MILLER ORCHARDS
RD #2, Box 176
Dummerston, VT 05346
(802) 254-9158

MOORE'S ORCHARD
Wallace & Emily Grube
North Pomfret, VT 05053
(802) 457-2994

SAXTONS RIVER ORCHARDS
Lester Eisner, Jr.
Leach Road Farms
Saxtons River, VT 05154
(802) 869-2443

SNOWFIELDS ORCHARD
B. W. Drew & Son
Box 89
Vershire, VT 05079
(802) 333-9526

WELLWOOD ORCHARDS, INC.
Roy Mark & Linda Weston
RFD #2, Box 350
Springfield, VT 05156
(802) 263-5200

"PICK YOUR OWN GROWERS IN VERMONT"

1983

OTHER FRUITS

ALLENHOLM FARM MARKET
Ray W. Allen
South Hero, VT 05486
(802) 372-5566
Cherries

CHARLOTTE BERRY FARM
Box 341, RR 1
Charlotte, VT 05445
(802) 425-3652
Raspberries

EQUINOX VALLEY NURSERY
Route 7A
Manchester, VT 05254
(802) 362-2610
Raspberries

FRUITLANDS
Dale & Janet Newton
Thistle Hill Road
Marshfield, VT 05658
(802) 426-3889
Raspberries

GOLDEN APPLE ORCHARD
Whalley Road
Charlotte, VT 05445
(802) 425-2060
Currants and Gooseberries

GREEN MOUNTAIN ORCHARDS
Bill Darrow
West Hill Road
Putney, VT 05346
(802) 387-5851
Blueberries

HARLOW'S SUGAR HOUSE
Donald Harlow
Putney, VT 05346
(802) 387-5852
Blueberries and Raspberries

HARWOOD HILL ORCHARD
Paul W. Bohne, III
Bennington, VT 05201
(802) 442-9524
Blueberries and Raspberries

HICKINS MOUNTAIN MOWING FARM
RD #1, Black Mountain Road
Brattleboro, VT 05301
(802) 254-2145
Black, Red, and Ever Bearing Raspberries

JEWETT BERRY FARM
Merrill W. Jewett
Hyde Park, VT 05655
(802) 888-2901
Raspberries

DWIGHT MILLER ORCHARDS
Dummerston, VT 05346
(802) 254-9158
Raspberries, Peaches, Blackberries and Blueberries

FRANCIS MILLER ORCHARDS
Box 203-B, Bonnyvale Road
West Brattleboro, VT 05301
(802) 254-6925
Peaches, Pears, and Plums

JACK AND TERRY LYONS
Turnpike Road
Norwich, VT 05055
(802) 649-1916
Raspberries

OVER THE HILL FARM
Lisa Dimondstein & Will Leas
RD, Box 5140
Morrisville, VT 05661
(802) 888-3777
Raspberries

ROGER & LYNN PURVEE
RD #1, Box 550
Johnson, VT 05656
(802) 635-7595
Raspberries

MOORE'S ORCHARD
Wallace & Emily Grube
North Pomfret, VT 05053
(802) 457-2994
Blueberries and Sour Cherries

PATTERSON ORCHARD
F. Alfred Patterson
Shoreham, VT 05770
(802) 897-5642
Cherries and Plums

"PICK YOUR OWN GROWERS IN VERMONT"

1983

VEGETABLES

ALLEN BROTHERS FARM & ORCHARDS
R #1, Box 325
Bellows Falls, VT 05101
(802) 722-3395
Potatoes

BRIGANTE BROTHERS
Malletts Bay Avenue
Colchester, VT 05446
(802) 655-0187
Tomatoes

EQUINOX VALLEY NURSERY
Route 7A
Manchester, VT 05254
(802) 362-2610
All Vegetables
Pumpkins

GOLDEN APPLE ORCHARD
Whalley Road
Charlotte, VT 05445
(802) 425-2060
All Vegetables

HUDAK'S ORGANIC FARM
Dick Hudak
RD #1
Swanton, VT 05488
(802) 527-7956
Tomatoes, Potatoes

LEGARE'S STAND
Route 14
Calais, VT 05648
(802) 454-7784
Tomatoes

SAMUEL P. MAZZA FARM
RFD #3
Colchester, VT 05446
(802) 655-3440
Tomatoes

OVERLOOK FARM
I. Stanford Zecher
Manchester, VT 05255
(802) 362-1635
Beans

PINE TREE FARM
D. Heffernan
RFD #2
Bristol, VT 05443
(802) 453-2587
Tomatoes, Potatoes

ROGER & LYNN PURVEE
RD #1, Box 550
Johnson, VT 05656
(802) 635-7595
Asparagus, other Vegetables

SCOTT'S GREENBUSH GARDENS
Box 19 (Greenbush Rd. off Rt. 7)
N. Ferrisburg, VT 05473
(802) 425-2370
Asparagus, Corn, Tomatoes

SHAW GARDENS
Route 110
South Royalton, VT 05068
(802) 763-8064
Peas, Potatoes, Beans, Corn, Beets, Carrots, Spinach, Squash, Tomatoes

CHARLES SIEGCHRIST
Barber Farm
Jericho, VT 05465
(802) 878-2607
Tomatoes

WILDER BERRY FARM
Julie & Cliff Wilder
River Road
Lunenburg, VT 05906
(802) 892-5985
Corn, Peas, Beans, Broccoli, Cauliflower, Squash, Pumpkins

WICKSTOCK FARMS
William Wicks
West Route 9
Bennington, VT 05201
(802) 447-7434
Tomatoes

WOOD'S MARKET GARDENS
RD #3
Brandon, VT 05733
(802) 247-6630
Peas, Beans, Tomatoes

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STRAWBERRIES

ALLEN BROTHERS
Lawrence R. Allen
Box 74
Westminister, VT 05158
(802) 722-3395

BRIGANTE BROTHERS
Malletts Bay Avenue
Colchester, VT 05446
(802) 655-0187

CHARLOTTE BERRY FARM
Box 341, RR 1
Charlotte, VT 05445
(802) 425-3652

DOUGLAS ORCHARDS
Shoreham, VT 05770
(802) 897-5043

EQUINOX VALLEY NURSERY
Route 7A
Manchester, VT 05254
(802) 362-2610

FARMER HODGES
Herbert & Beverly Hodge
Fairlee, VT 05045
(802) 333-4483

FORBES MAPLE AND BERRY FARM
Elbert E. Forbes
RFD #3
Middlebury, Vt 05753
(802) 388-2387

GOLDEN APPLE ORCHARD
Whalley Road
Charlotte, VT 05445
(802) 425-2060

GREEN MOUNTAIN SUGAR HOUSE
David S. Harlow
RFD #1
Ludlow, VT 05149
(802) 228-7151

H & M ORCHARD
Donald Hazelton
RFD #2
Dummerston Ctr., VT 05346
(802) 254-8100

HARLOW'S SUGAR HOUSE
RFD #1, Box 100
Putney, VT 05346
(802) 387-5852

HARWOOD HILL ORCHARD
Paul W. Bohne, III
Bennington, VT 05201
(802) 442-9524

LINN HAZEN
North Hero, VT 05464
(802) 372-4284

ROSEWELL HEBARD
RFD #1
South Royalton, VT 05068
(802) 763-7019

HEERMANSMITH FARM
Jack Smith
Coventry, VT 05825
(802) 754-8866

HICKINS MOUNTAIN MOWINGS FARM
RD #1, Black Mountain Road
Brattleboro, VT 05301
(802) 254-2146

JEWETT BERRY FARM
Merrill W. Jewett
Hyde Park, VT 05655
(802) 888-2901

LEWIS CREEK FARM
Box 123
Starksboro, VT 05487
(802) 453-4591

SAMUEL P. MAZZA FARM
RFD #3
Colchester, VT 05446
(802) 655-3440

FRANCIS MILLER ORCHARDS
Box 203-B, Bonnyvale Road
West Brattleboro, VT 05301
(802) 254-6925

MOUNTAIN VIEW FARM
Sonja Ullrich
Charlotte, VT 05445
(802) 425-3215

OVER THE HILL FARM
Lisa Dimondstein & Will Leas
RD, Box 5140
Morrisville, VT 05661
(802) 888-3777

ROGER & LYNN PURVEE
RD #1, Box 550
Johnson, VT 05656
(802) 635-7595

SCOTT'S GREENBUSH GARDENS
Box 19, Greenbush Road
North Ferrisburg, VT 05456
(802) 425-2370

SHEP'S BERRY PATCH
RD #1
Hartland, VT 05048
(802) 436-2017

LEGARE'S STAND
Route 14
Calais, VT 05648
(802) 454-7784

LITTLEWOOD FARM
Bob & Lee Light
Plainfield, VT 05667
(802) 454-7725

DWIGHT MILLER & SON
Dwight Miller, Jr.
Dummerston, VT 05346
(802) 254-9158

MOORE'S ORCHARD
Wallace & Emily Grube
North Pomfret, VT 05053
(802) 457-2994

ERIC NYE
RD
Georgia, VT 05468
(802) 524-2826

DAVID PIERSON
Bradford, VT 05033
(802) 222-4444 or
(802) 222-4602

ROBERT'S STRAWBERRY FARM
c/o Marie Connell
RFD #2
Randolph, VT 05060
(802) 728-5705

SHAW GARDENS
Route 110
South Royalton, VT 05068
(802) 763-8064

CHARLES SIEGCHRIST
Barber Farm
Jericho, VT 05465
(802) 878-2607

SNOW'S GARDEN
Walter Snow & Sons
Stowe, VT 05672
(802) 253-7766 or
(802) 253-7728

NAPOLEAN H. VEZINA
RD #1
South Royalton, VT 05068
(802) 763-8582

WILDER BERRY FARM
Julie & Cliff Wilder
River Road
Lunenburg, VT 05906
(802) 892-5985

SOMERHILL FARM
Hez & Marion Somers
West Barnet, VT 05870
(802) 633-2883

WICKSTOCK FARMS
William Wicks
West Route 9
Bennington, VT 05201
(802) 447-7434

WOOD'S MARKET GARDENS
RD #3
Brandon, VT 05733
(802) 247-6630

APPENDIX V

PERIODICALS HAVING TO DO WITH THE FOOD SYSTEM*

1. Advances in Ecological Research
2. Agriculture Ecosystems and Environment
3. Agriculture Water Management
4. Agronomy Journal
5. American Vegetable Grower
6. Farm and Food Research
7. Farm Journal
8. FAO Plant Protection Bulletin
9. Food Engineering
10. Food and Nutrition
11. Food Policy
12. Food Technology
13. Journal of Food Protection
14. Journal of Food Science
15. Journal of Soil and Water Conservation
16. Nutrition Action
17. Nutrition Reports International
18. Nutrition Today
19. Nutrition Week
20. Proceedings of the Nutrition Society

* All titles are available at the University of Vermont Library